



Roseau River

Integrated Watershed Management Plan



Acknowledgements

The Seine Rat Roseau Watershed District, as the Water Planning Authority for the Roseau River Watershed, would like to acknowledge and thank their watershed residents and partners for their support, input and participation in the development of the Roseau River Integrated Watershed Management Plan.

Many thanks to the members of the Watershed Team and supporting organizations for their help in the development of this plan, including Manitoba Agriculture and Resource Development – Water Branch, Lands Branch, and Wildlife and Fisheries Branch; Manitoba Conservation and Climate – Environmental Compliance and Enforcement, Office of Drinking Water, Parks and Protected Spaces, and Water Use Licensing; Manitoba Infrastructure; Manitoba Indigenous and Northern Relations; Manitoba Municipal Relations; Manitoba Forestry Association; Nature Conservancy of Canada; South East Snowriders; Native Orchids Conservation Inc.; Roseau River Watershed District (Minnesota); and local municipalities.

A special thank you to all the members of the Project Management Team for your leadership, direction, input and invaluable oversight to complete this integrated watershed management plan.

The late Jim Swidersky, Chair (2013-2018)	<i>Rural Municipality of Stuartburn</i>
Greg Janzen, Vice-Chair (2013-2017)	<i>Municipality of Emerson-Franklin</i>
Orest Kuryk, Vice-Chair (Alternate)	<i>Municipality of Emerson-Franklin</i>
Harold Janzen, Vice-Chair (2017-2020)	<i>Rural Municipality of Montcalm</i>
Ed Penner, Chair (2018-2020)	<i>Roseau River Watershed Sub-District 2, Chair & Rural Municipality of Stuartburn</i>
Ken Prociw	<i>Rural Municipality of Piney</i>
Cornie Goertzen	<i>Seine Rat Roseau Watershed District, Chair (2003-2020)</i>
Jake Hiebert	<i>Seine Rat Roseau Watershed District, Chair (2020)</i>
Jodi Goerzen	<i>Seine Rat Roseau Watershed District, Manager</i>
Dorthea Gregoire	<i>Seine Rat Roseau Watershed District, Watershed Technician</i>
Dale Timmerman, Principal Author	<i>Manitoba Agriculture and Resource Development</i>

Cover photo credit: Amy Jaarsma



DEDICATED TO JIM SWIDERSKY

The Project Management Team would like to dedicate this plan in memory of Jim Swidersky, aka “Big Jim.”

Jim was a long-time advocate and champion of sustainable watershed management through his role as Vice-Chair of the Seine Rat Roseau Watershed District, as former Reeve of the Municipality of Stuartburn, and as Chair of the Project Management Team. Jim was a champion of local people and places. His strong conservation ethic, leadership, direction, knowledge and passion will live on.

Thank you “Big Jim.”

Contents

Introduction	4
Key Players	5
Transboundary Partnerships and Planning	7
Roseau River Watershed	8
Watershed Demographics	8
Watershed Description	9
Climate	11
Topography	12
Surface Water Flows (Hydrology)	13
Soils and Land Use	15
Agricultural Use	17
Aquifers and Groundwater Resources	19
Surface Water Quality	21
Biodiversity and Natural Areas	25
Forestry and Peatlands	27
Distributed Retention Study	29
Drought Preparedness Study	32
Watershed Priorities	36
Implementation Plan	38
Priority 1: Surface Water Management	38
Priority 2: Groundwater Quality and Quantity	54
Priority 3: Surface Water Quality	58
Priority 4: Ecosystem Health and Natural Areas	64
Linking to Development Planning	68
References and Plan Linkages	70

Introduction

The Roseau River Watershed is a diverse watershed located in Southeastern Manitoba, straddling both sides of the Canada-US border. The headwaters of the Roseau River Watershed originate in both Manitoba and Minnesota. Tributaries flow toward the main stem, which originates in Minnesota and flows in a northerly direction into Manitoba. The Roseau River eventually joins the Red River approximately 100 kilometres south of the City of Winnipeg. The flow of water through this unique transboundary watershed has defined local industry, society and culture. The Canadian portion of the watershed is home to approximately 7,000 residents and supports recreational tourism, agriculture, forestry and local industry.

The Seine Rat Roseau Watershed District is designated as the Water Planning Authority for the Roseau River Watershed under The Water Protection Act. In 2014, the district initiated an integrated watershed management plan under this authority. This 10-year integrated watershed management plan outlines goals and actions to manage land and water resources on a watershed basis. It is a shared effort through the cooperation of multiple organizations including the watershed district, all levels of government, Indigenous communities, non-government conservation agencies, community groups and watershed residents.

This plan outlines actions to address land and water priorities for the Manitoba portion of the Roseau River Watershed. The plan serves as a tool for residents, government agencies and other stakeholders to coordinate decision making and action across the watershed. It is designed to help influence how decisions are made on land and water management, and where conservation dollars are targeted. The plan will help build climate resilience throughout the watershed. Each plan is unique and reflects local goals, issues and priorities of the watershed. Many people and organizations have contributed to the development of this plan and will be involved in its implementation.

Watershed Management Planning

A watershed is an area of land where all precipitation drains to a common downstream point, such as a lake or river. Water that soaks into the ground can contribute to groundwater and may eventually resurface at a location elsewhere in the watershed.

Watersheds are considered the most ecologically and administratively appropriate unit for managing water. Planning based on a watershed provides the opportunity to address water quality and quantity issues, as well as cumulative impacts of land and water management practices, beyond the scope of single jurisdictions. Planning this way also corresponds with the reality that upstream activities influence downstream conditions.

In 2021 the Province of Manitoba approved The Roseau River Integrated Watershed Management Plan under The Water Protection Act. This plan provides a road map for the watershed over the next 10 years.

Key Players



Watershed residents, community leaders, and technical experts were instrumental in the development of this plan.

Watershed Residents

Watershed Residents are the most important participants in watershed management planning and implementation. Early in the planning process, three public consultation meetings were held in communities throughout the watershed. The Roseau River Integrated Watershed Management Plan (IWMP) is a reflection of collective local knowledge, values, and concerns of watershed residents.

The Water Planning Authority

The Water Planning Authority is designated under The Water Protection Act to develop an integrated watershed management plan. Under this Act and regulation, the Manitoba government designated the Seine Rat Roseau Watershed District as the Water Planning Authority for this watershed.

The Project Management Team

The Project Management Team is a small group of local residents that represents the watershed and acts as the key decision-maker during plan development. The Project Management Team met regularly throughout the development of the plan, developed communication materials, hosted public and stakeholder meetings, and finalized the content of this watershed plan.

The Watershed Team

The Watershed Team consists of a group of community representatives and technical experts from key stakeholder organizations and all levels of government. The role of the Watershed Team is to provide technical knowledge and guidance throughout the development of the plan.

The Seine Rat Roseau Watershed District

The Seine Rat Roseau Watershed District was formed in 2002 and includes the Rural Municipalities of Springfield, Ste. Anne, Taché, Hanover, La Broquerie, Piney, Reynolds, De Salaberry, Stuartburn, Montcalm, the Municipalities of Emerson-Franklin and Ritchot, the Towns of Ste. Anne and Niverville, the Village of St. Pierre-Jolys, and the City of Steinbach. Watershed districts are non-profit, grassroots organizations governed by a local board and funded through a provincial-municipal partnership. The district has a mandate to address watershed issues and offers

Addressing Watershed Issues

The Seine Rat Roseau Watershed District uses local knowledge, technical expertise and board recommendations to address local watershed health concerns. Learn more at www.srrwd.ca.

incentive-based programming to improve soil and water quality, aquatic and riparian health, and environmental education programming. As the designated water planning authority, the Seine Rat Roseau Watershed District (SRRWD) will lead and monitor implementation progress of the Roseau River Integrated Watershed Management Plan.

Indigenous Communities of the Watershed

The Roseau River flows through traditional Ojibway lands, Treaty 1 and Treaty 2 territory, and the homeland of the Métis Nation. The watershed includes Roseau River Anishinaabe First Nation and the Buffalo Point First Nation Community Interest Zone.

Historically, the Roseau River Watershed provided its Indigenous peoples with essential forms of food like bison, venison and wild rice, as well as water, shelter and transportation. Many natural features, including the plants and animals that inhabit the land and water, continue to provide important physical, spiritual and medicinal value to watershed residents. Elders inherited these teachings from their ancestors and pass them along to their descendants.

Roseau River Anishinaabe First Nation

Roseau River Anishinaabe First Nation is one of two Indigenous communities with direct ties to the Roseau River Watershed in southern Manitoba. It has a registered population of approximately 2,100 individuals, half of which live outside the watershed. The Roseau River Anishinaabe First Nation has three reserves, with the largest, Roseau River No.2 at 22 square kilometres, serving as the main community. It borders the Municipality of Emerson-Franklin and the Rural Municipality of Montcalm near the outlet of the Roseau River to the Red River.

Roseau Rapids No. 2A is considerably smaller at 3.23 square kilometres and lies approximately 35 kilometres northeast of the main community along the northern border of the watershed. Roseau River No. 2B is the smallest portion and is located outside the watershed on the northwest side of Winnipeg along the Perimeter Highway. Roseau River Anishinaabe First Nation is a member of the Dakota Ojibway Tribal Council.

Buffalo Point First Nation

Buffalo Point First Nation is an Ojibway or Saulteaux band, governed by a traditional hereditary system of leadership. It is located in the southeastern corner of Manitoba along the shores of Lake of the Woods. Although the reserve land falls just outside the Roseau River Watershed, the watershed contains part of Buffalo Point First Nation's Community Interest Zone.



Photo credit: Monique Chenier

Transboundary Partnerships and Planning

As a transboundary watershed, located along the Canada-US international border, the Roseau River Watershed has a long history of international cooperation and planning efforts. While this integrated watershed management plan primarily addresses the Manitoba portion of the watershed, it also recognizes and builds upon the strong watershed management efforts by partners in Minnesota.

International Partners

Roseau River Watershed District (RRWD) is located in Northern Minnesota along the international border and is part of **Minnesota's Red River Watershed Management Board**. Established in 1920, the district is run by a board of directors with an office and staff located in Roseau, Minnesota. Roseau River Watershed District's mission is to manage the waters and related resources within the district in a reasonable and orderly manner to improve the general welfare and public health of the residents of the district.

Roseau River Watershed District has an established international partnership with Seine Rat Roseau Watershed District in Manitoba, and together these two grassroots organizations play an active role in watershed management for the Roseau River. Additional information regarding the Roseau River Watershed District can be found at roseauriverwd.com.

The **Roseau River International Watershed (RRIW)** was established in 2000 as an alliance between Manitoba and Minnesota. The group's mission is to conduct proper resource management in the Roseau River Watershed, including flood control, economic, human and natural resources, and water quality and quantity.

In 2007, the group developed a plan for the Canadian portion of the Roseau River Watershed to address the following issues: flood damages to infrastructure, farmland and property; adequate and safe water supply; and personal safety and economic

development. Many of the goals and associated action items remain a priority for the RRIW, and have been adopted by organizations on both sides of the border, including Seine Rat Roseau Watershed District.

The **Red River Basin Commission (RRBC)** was formed to advance grassroots efforts to address land and water issues throughout the entire Red River Basin, including the Roseau River Watershed. It is a non-profit corporation dedicated to innovation in Red River Basin water resource management, and it maintains offices in Fargo, North Dakota and Winnipeg, Manitoba (Figure 1).

The RRBC has developed thirteen basin-wide goals and objectives for water management in key areas and continues to work toward them. The Roseau River IWMP is in agreement with these goals which can be read in detail at redriverbasincommission.org.



FIGURE 1: RED RIVER BASIN OVERVIEW.

Roseau River Watershed

Watershed Demographics

Overall, the Roseau River Watershed is more sparsely populated than other regions in southern Manitoba. Table 1 summarizes population demographics for the municipalities and Indigenous communities within the watershed. It is important to note that portions of the municipalities lay outside the extent of the watershed. This is particularly relevant for the Rural Municipality of Montcalm, where the majority of the municipality and population reside outside the watershed. This has not been accounted for in the numbers reported in Table 1 as they are reflective of the entire census area.

CENSUS AREA	2016 POPULATION
Emerson-Franklin	2,537
Montcalm	1,260
Piney	1,726
Stuartburn	1,648
Roseau River Reserve No. 2	588
Roseau Rapids Reserve No. 2A	114

TABLE 1: POPULATION DEMOGRAPHICS FOR CENSUS AREAS.



Photo credit: Sandra Drewniak

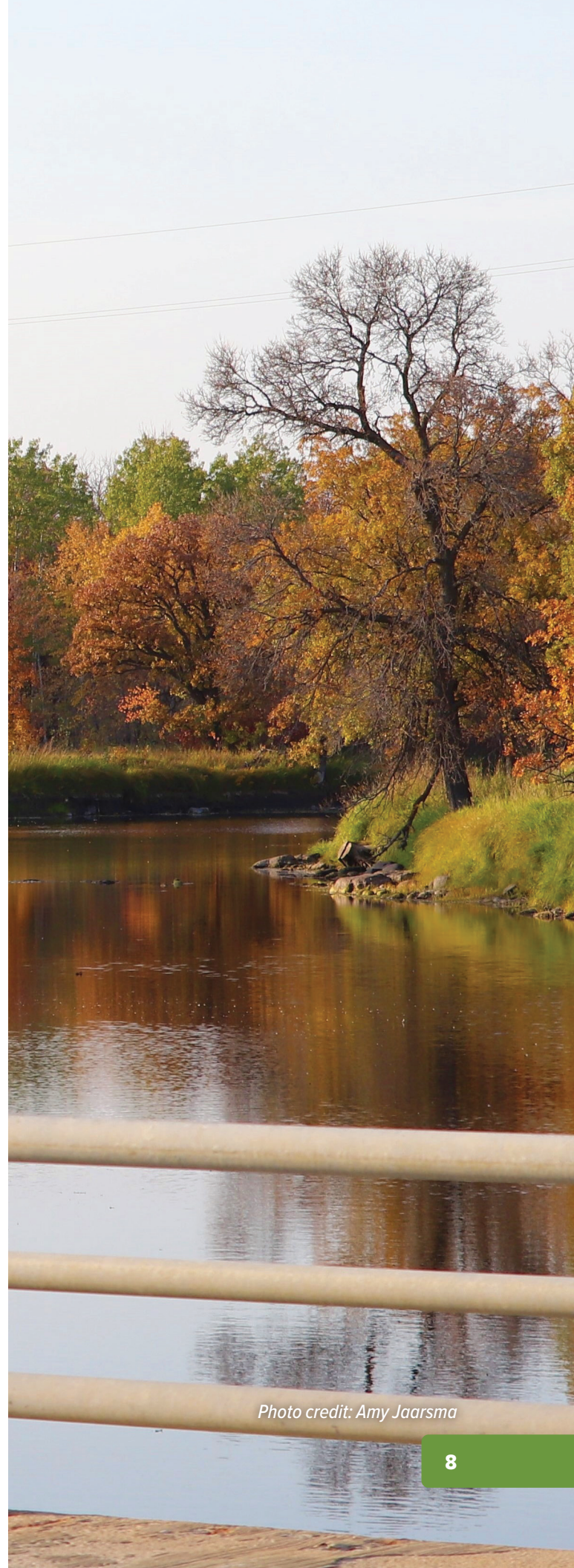


Photo credit: Amy Jaarsma

Watershed Description

The entire Roseau River Watershed is located in southeastern Manitoba and northwestern Minnesota and has a gross drainage area of approximately 5,820 square kilometres (Figure 2). Of the land that contributes to the Roseau River Watershed, 52% is in Minnesota and the remaining 48% is in Manitoba. The Roseau River Watershed is a small component of the much larger Red River Basin—which has a drainage area of approximately 116,550 square kilometres, excluding the drainage area within the Assiniboine River Basin.

The main channel of the Roseau River originates just north of Roseau, Minnesota, draining a number of

tributaries on both sides of the border such as Sprague Creek, Hay Creek and South Fork Roseau River. From this point, the river flows in a northwesterly direction, crossing the Canada-US border at roughly the midpoint of the river. From the border, the river continues to flow in a northwest direction across the Manitoba portion of the watershed, prior to turning west. Here, it flanks the north side of the community of Dominion City and it then flows through the Roseau River Anishinaabe First Nation before joining the main stem of the Red River just east of the Town of Letellier, Manitoba. The Red River continues to flow northward, through the City of Winnipeg, and eventually drains into Lake Winnipeg.

The Roseau River meanders for approximately 340 kilometres across the basin from source to mouth.

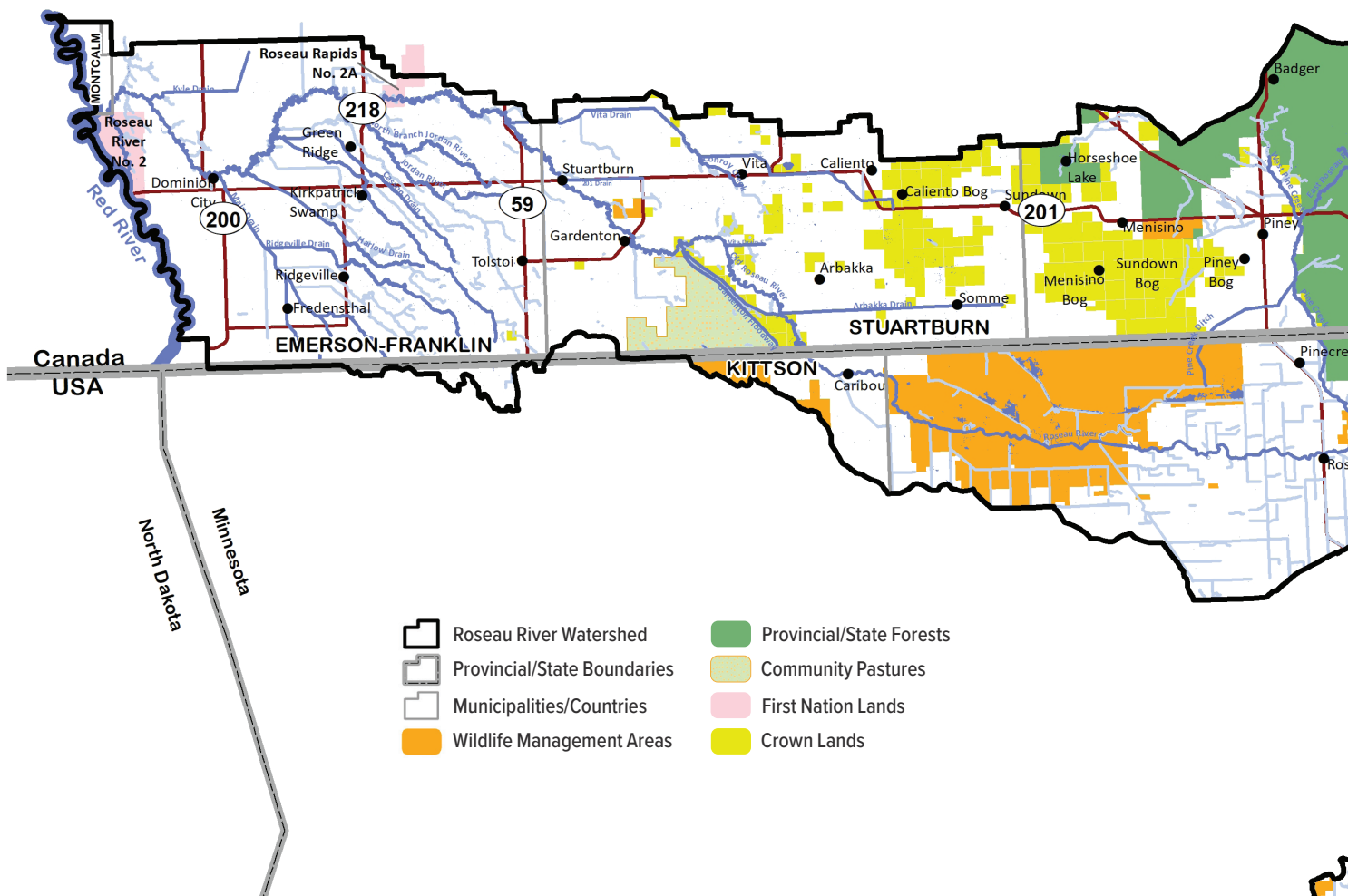
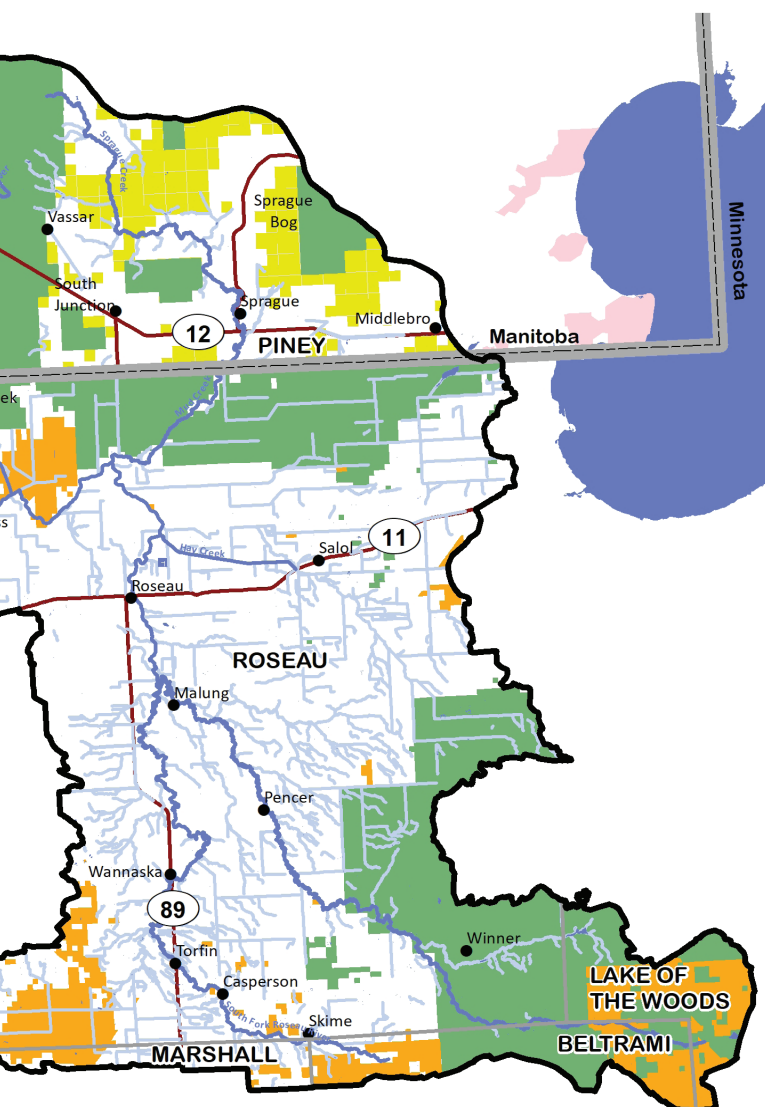


FIGURE 2: THE CANADIAN AND AMERICAN PORTIONS OF THE ROSEAU RIVER WATERSHED.

Channelization, as well as a number of diversions, blockages and control structures, have altered the natural course of the river on both sides of the international border.

Four main tributaries contribute flow to the Roseau River main channel, converging close to Roseau, Minnesota. The headwaters for two of these tributaries, the South Fork Roseau River and the Hay Creek, originate in the extreme southeastern and eastern portions of the watershed on the American side of the border. The headwaters for the remaining two tributaries, the Pine and Sprague Creeks, originate in the extreme northeastern and eastern portions of the watershed on the Canadian side of the border.



In addition to the main tributaries, a series of permanent wetlands contribute to the overall water system of the Roseau River Watershed in Canada. These include the Caliento, Sundown, Menisino, Piney, and Sprague Bogs, the Somme and Kirkpatrick Swamps, and Horseshoe Lake. There is also a large wetland complex north of Vassar which generally feeds into Sprague Creek, depending on water levels, blockages and other factors. Collectively, all of these wetlands hold and release runoff, help recharge groundwater, and serve as vital habitat for animals, waterfowl and aquatic species.

A number of large-scale drains have been constructed in the watershed, particularly in the western region of the watershed where topography is relatively flat in the Municipalities of Emerson-Franklin and Stuartburn. These include the Kyle Drain just north of Roseau River First Nation, the Ridgeville and Fredensthal Drain which join to form the Main Drain, the Harlow Drain, the Casson Drain, the Jordan River/Drain, the 201 Drain, the Vita and Vita South Drains, and the Arbakka Drain (Figure 2).



Climate

The Roseau River Watershed has a continental climate characterized by high degrees of seasonality between summer and winter, large inter-annual precipitation variability, short and hot summers, and long, cold winters. The average number of frost free days per year varies greatly across the watershed, ranging from approximately 130 days per year in the west to 100 days per year in portions of the eastern watershed. In relation to the rest of southern Manitoba, this region is slightly wetter as low pressure systems originating from the lee-side of the American Rocky Mountains commonly pass northeastward through the watershed towards the Great Lakes, bringing occasional heavy precipitation. In general, about one-fifth of total annual precipitation is in the form of snowfall, approximately 90% of which occurs during the November to March period. The remaining 10% generally occurs in either April or October. Based on 100 years of data from Environment and Climate Change Canada, the annual

average precipitation ranges from approximately 510 to 575 mm. Average monthly precipitation typically peaks in June and July (Figure 3).

Climate Variability

Periods of drought and excess moisture characterize the Roseau River Watershed. Within the last hundred years, residents of the watershed have experienced dramatic variability: everything from drought to extreme precipitation events and overland flooding. It is anticipated that the frequency, intensity and unpredictability of these events will increase with global climate change. Ever-shifting weather patterns continue to have a strong influence on local industries; in particular, the agricultural sector. Extended droughts in the 1930s and 1980s and major flooding in the 1950s and 1990s highlight the fluctuating nature of water in this watershed. In recent years, watershed residents have experienced both flood and drought within the same growing period.

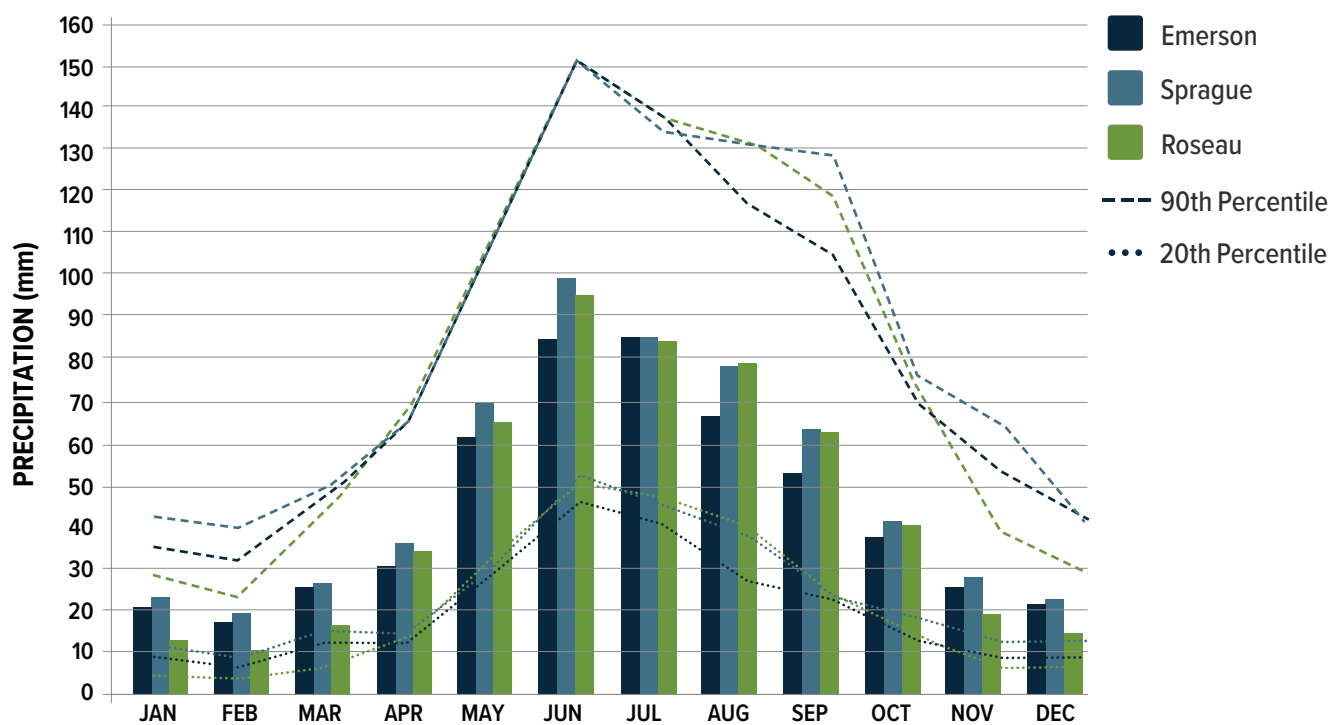


FIGURE 3: AVERAGE MONTHLY PRECIPITATION (1916-2019) IN SPRAGUE, EMERSON AND ROSEAU.

Topography

The topography of the Roseau River Watershed was shaped thousands of years ago in the last glacial period. An enormous glacier melted and retreated northward across Manitoba, creating many recognizable topographical features. The Red River Valley and Lake Winnipeg, which receives water from the Roseau River through the Red River, are modern-day evidence of the larger Glacial Lake Agassiz.

The Roseau River Watershed is characterized by an elevation change of 158.5 metres over an approximate distance of 100 km (Figure 4). The highest elevation in the watershed is north of Badger in the Sandilands Provincial Forest, between Vassar and Piney, where elevations reach 384 metres above sea level. This area is part of the former eastern shoreline of Glacial Lake Agassiz, where heavier sand and gravel deposits were reworked by wave action as the glacier melted and retreated. The lowest elevation of 227 metres above sea level occurs along the Red River within the Roseau River No. 2 First Nation in the downstream portion of the watershed where the Roseau River flows into the Red River. Here Glacial Lake Agassiz deposited organic matter and finer silt and clay particles that form the fertile agricultural lands of the vast Red River Valley today. Due to the gradual slope and flat topography, water tends to flow more slowly here and when the Roseau River exceeds its banks during high flow years, water can spread out over large areas of relatively flat land.

Obtaining Elevation Data Through LiDAR

LiDAR stands for Light Detection and Ranging; and is technology that provides very detailed digital elevations of the landscape. It is acquired by aircraft or drones that are equipped with special sensors.

The Roseau River Watershed has LiDAR coverage and these data are used by the SRRWD, municipalities, government departments and others for surface water management planning purposes including drainage, water retention, wildlife habitat and land and river form management.

All of SRRWD's programming is supported by in-house use of LiDAR data. Project design and implementation has become more efficient with the availability of LiDAR data.

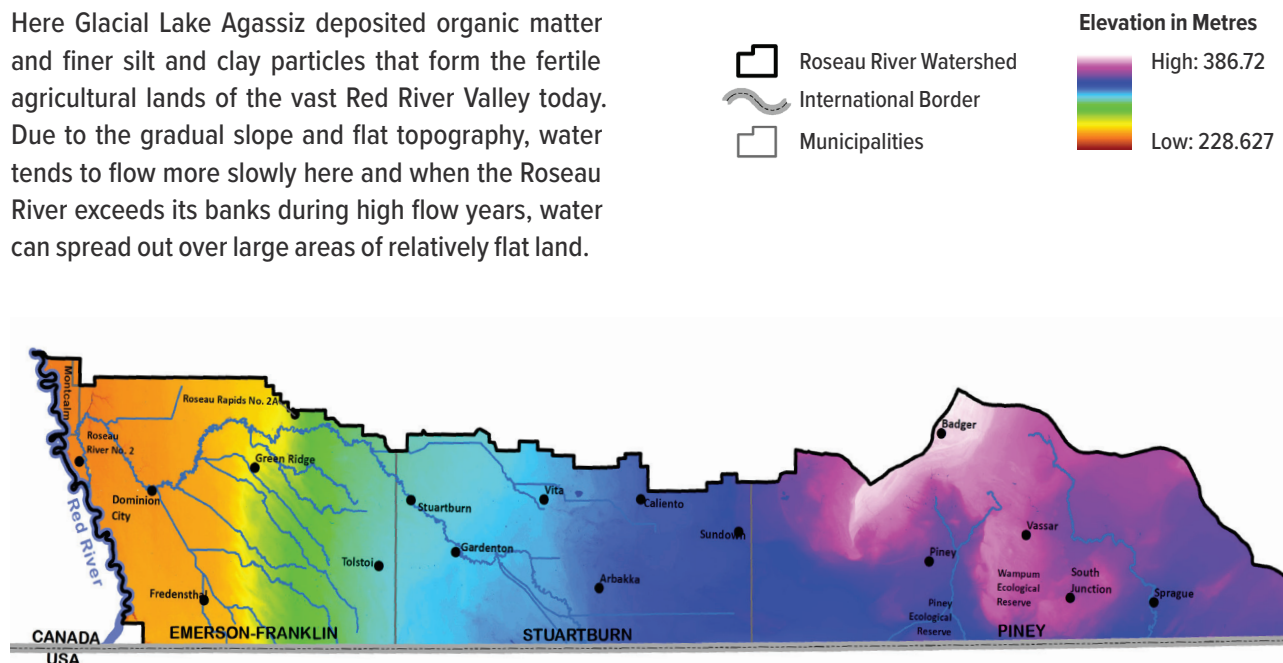


FIGURE 4: TOPOGRAPHY OF THE ROSEAU RIVER WATERSHED.

Surface Water Flows (Hydrology)

Flow Conditions

Local weather patterns and precipitation events influence the tributaries and drains that contribute water to the Roseau River. Flow conditions can vary widely from year to year and seasonally within the same year. In recent years, residents of the watershed have observed changes in flow patterns. In particular, fall precipitation events have resulted in higher flows in drains and tributaries than observed historically. For the Pine and Sprague Creeks, discharge from wetlands in the eastern and central portions of the watershed can provide base flow even during dry seasons. In contrast, the clay soils over deep lacustrine deposits around the artificial drains in the western part of the Roseau River Watershed do not contribute base flow easily, but rather facilitate faster rates of runoff. In some months, there is little to no discharge from these western waterways.

Stream Monitoring

Stream flow and water level data have been recorded at 17 locations within the Roseau River Watershed for varying time periods since 1910 (Figure 5). In the Roseau River Watershed, the majority of flow is generated from snow melt and spring rains. Roughly 65% of the flow on the Roseau River occurs from April

to June. Flow volumes drop throughout July, August and September, increase slightly in October, and drop again over the winter months.

Annual flows in the Roseau River can vary greatly due to highly variable precipitation patterns, ranging from severe flooding to severe drought. This variation is typical for prairie watersheds. The highest recorded annual volume of water in the Roseau River was approximately 1,000,000 dam³ in 2004, which is nearly 25 times more than the lowest recorded annual volume of 40,400 dam³ in 1988.

Did You Know?

Annual flow volume refers to the total volume of water that passes by a recording hydrometric station over an entire year, while peak flow rate refers to the maximum flow of water passing by a recording station at a particular point in time. High peak flows often associated with excess spring snowmelt or severe rain events do not necessarily equate to high annual flow volumes recorded for any particular year. Conditions can easily go from wet to dry, or vice versa, thus affecting annual flow volumes.

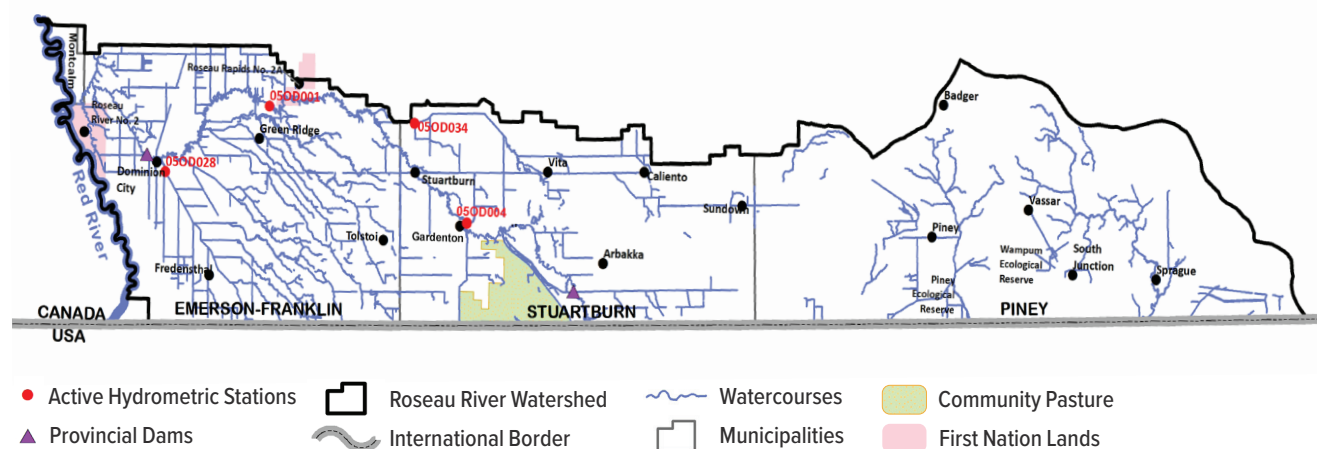


FIGURE 5: ACTIVE HYDROMETRIC STATIONS IN THE ROSEAU RIVER WATERSHED.

The average annual volume of water contributed by the Roseau River to the Red River (370,000 dam³) represents 7.7% of the total average volume of flow for the Red River measured at Ste. Agathe (4,817,000 dam³) and 5.5% of the total average volume of flow for the Red River measured at Lockport (6,774,000 dam³). The percent contribution of the Roseau River decreases at Lockport due to the addition of flow from the Assiniboine River within the City of Winnipeg.

The highest peak flow rate recorded in the Roseau River was approximately 230 cubic metres per second (over 50,000 gallons per second) in 1950, which is enough

water to fill an Olympic sized swimming pool (2,500 cubic metres) every 10 seconds (Figure 6). Manitoba experienced one of the worst spring floods on record in 1950 with many communities and farmyards and a large portion of the City of Winnipeg was inundated with floodwaters. The lowest peak flow rate recorded on the Roseau River was in 1939 with under 10 cubic metres per second (10,000 gallons/second) during the end of the Great Depression. This variation in flow conditions contributes to many water management challenges.

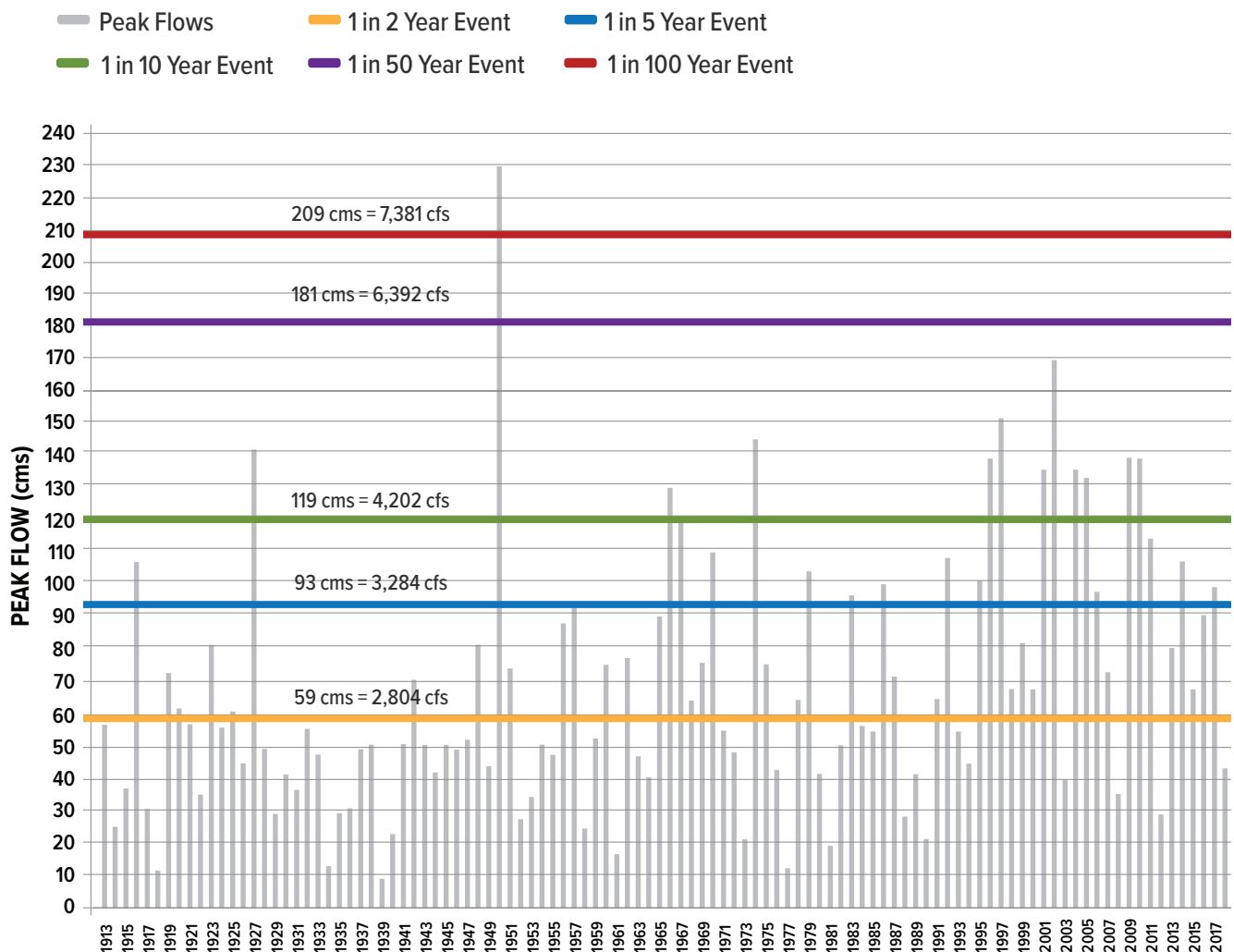


FIGURE 6: ANNUAL PEAK FLOW RATES (CUBIC METRES PER SECOND) COMPARED TO FLOOD PEAK EVENTS FOR ROSEAU RIVER NEAR DOMINION CITY AT P.R. 218 (050D001).



Photo credit: Sara Schubert

Soils and Land Use

Agriculture plays a significant role in the Roseau River Watershed and influences many dynamics including watershed health and integrity, land use practices, and community and economic development. Agricultural production is primarily concentrated in the western, downstream region of the watershed in the municipalities of Montcalm, Emerson-Franklin and portions of Stuartburn (Figure 7). The intensity of production, farm size and farm numbers decrease as you move east to the upland region of the watershed in the Rural Municipality of Piney, where agricultural land is found in pockets within a predominately forested area.

Land is classified in terms of agricultural productivity according to the Canada Land Inventory System, which classifies lands progressively from Class 1 to Class 7 (Figure 8). Class 1 is the highest rating with no limitations to annual crop production, and Class 7 is the lowest rating with severe limitations that are not suitable for agriculture. Soil formation factors such as climate, native vegetation, parent material (geology), topography, and time influence the degree of limitation and capability class rating. Each class can be further divided into subclasses that define the types of limitations, including attributes like salinity, stoniness, inundation, wetness, shallow soils, erosion, topography and others. Collectively, all class and subclass variables directly influence farm demographics in the watershed, including the type of farm, crop rotations, how land and soil are managed, and overall productivity.



Land Use in the Watershed

Forages	4%	Annual Cropland	23%
Grasslands	17%	Treed Areas	44%
Urban Areas	2%	Water/Wetlands	10%

Soil Class in the Watershed

Class 2	12%	Class 5	25%
Class 3	17%	Class 6	10%
Class 4	16%	Organic Soils	20%

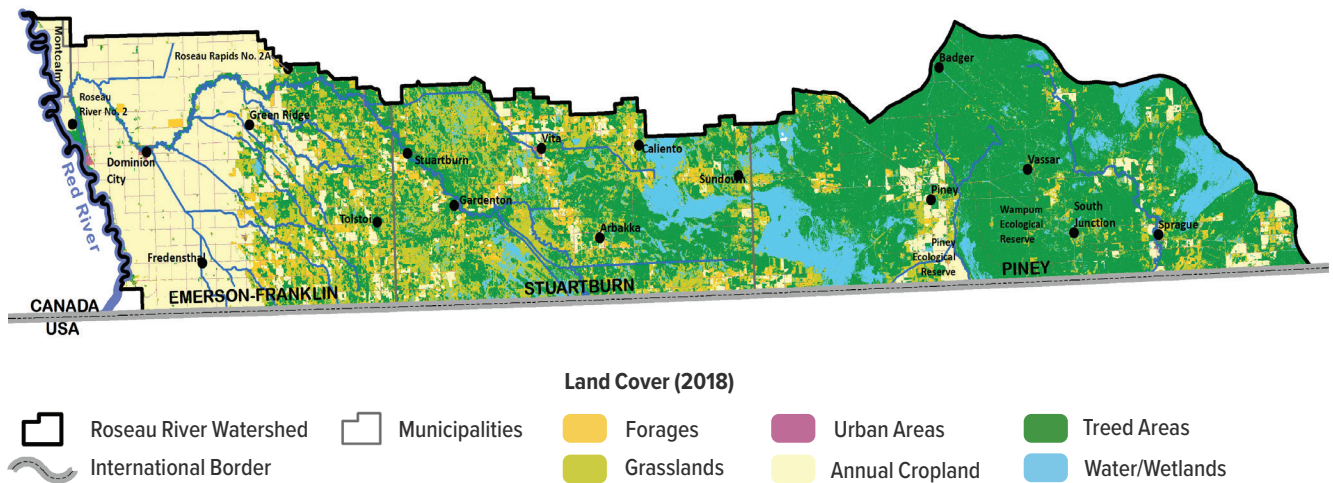


FIGURE 7: LAND COVERAGE MAP FOR ROSEAU RIVER WATERSHED.

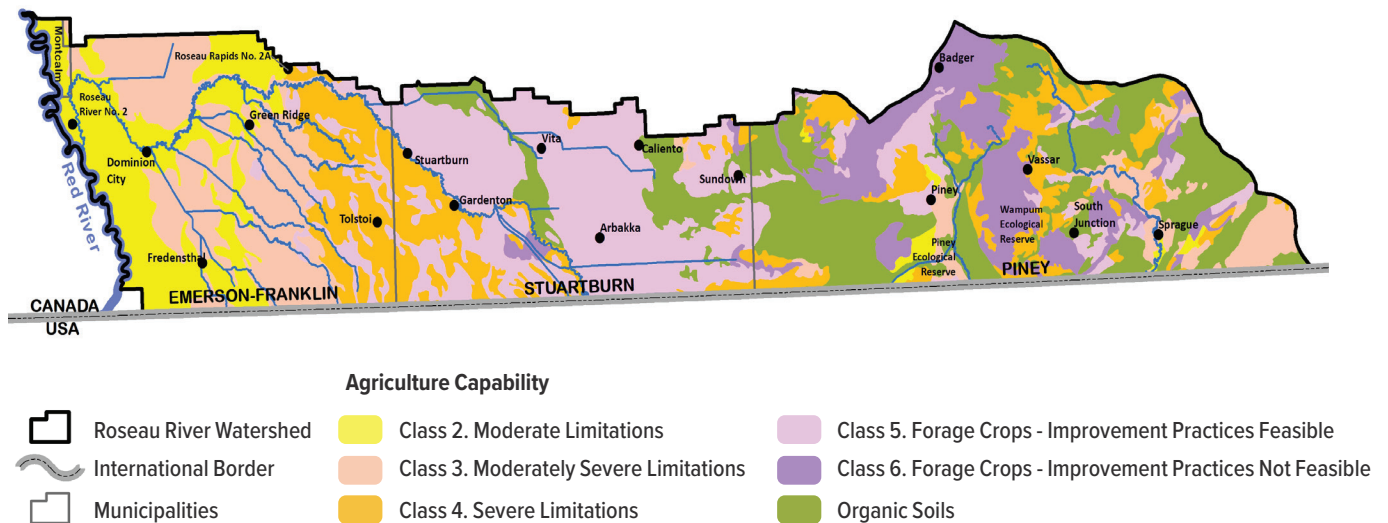


FIGURE 8: AGRICULTURE CAPABILITY MAP FOR ROSEAU RIVER WATERSHED.

Approximately 12% of the land in the Roseau River Watershed is classified as highly productive with moderate limitations for agricultural crop production. These soils are primarily concentrated in the Red River Valley where fine clay to loam sediments were left by Glacial Lake Agassiz. The lake-formed lacustrine soils are deep, rich and very fertile. Surface water management developments including constructed ditches and drains have facilitated intense annual crop production with a diversity of cereal, oilseed, and pulse crops in rotation. Due to the heavier clay soil texture, most land is intensely tilled to dry and prepare it from one crop year to the next.

At the mid-point in the Municipality of Emerson-Franklin, soils and agricultural land use change abruptly. Soils change to sandy and coarse loamy textured lacustrine sediments underlain by stony, extremely calcareous glacial till deposits. Local areas of water-worked gravelly sand outwash are common. These soils occur throughout most of the Rural Municipality of Stuartburn where the majority of land is Class 4 with severe limitations for annual crop production or Class 5 land suitable for forage production. These soil attributes are reflected in the local emphasis on forage and livestock production. In areas where parcels of Class 2 and 3 lands are intermixed with Class 4 land, mixed farming operations occur. Organic soils and wetland areas are also located in this region and are not suitable for agricultural production.

As you move eastward through the watershed, numerous bog and swamp complexes run in a diagonal line across the eastern side of the Rural Municipality of Stuartburn and into the Rural Municipality of Piney, where the landscape transforms into predominantly forested upland habitat. Soils consist of sandy and gravelly outwash and beach deposits along the former shorelines of Glacial Lake Agassiz. There are some pockets of agricultural land found in this area of the basin, ranging from Class 2 to Class 4, but this area remains largely natural with native grasslands, forests, and wetlands.

Agricultural Use

Over the twenty five year period from 1991 to 2016, there has been a 45% reduction in number of farm operations in the watershed. This pattern is seen across Canada as farmers retire and land is consolidated into larger operations. The livestock industry accounts for the largest segment of farm operations in the watershed and is predominantly found on Class 4, 5, and 6 soils. Many large hog operations in the watershed co-habit the same land as cattle operations to isolate operations from larger population centres, achieve manure management goals, and increase forage and pasture yields for grazing animals.

	Montcalm	Emerson-Franklin	Stuartburn	Piney	Watershed Avg.
Annual Crop Land	87	60	7	5	23
Forage Production	-	11	6	1	6
Native Grassland	2	11	35	12	18
Forested Areas	4	13	37	60	40
Wetlands & Water	4	1	14	20	12

TABLE 2: AGRICULTURAL LAND USE PERCENTAGES REPORTED BY MUNICIPALITY IN THE ROSEAU RIVER WATERSHED IN 2016 CENSUS.



Photo credit: Sandra Drewniak

Aquifers and Groundwater Resources

Groundwater provides base flow to rivers and streams in the watershed and is an important component in sustaining many local wetlands. It is also the primary source of rural, municipal, agricultural and industrial water supply in the Roseau River Watershed. Most residents, with the exception of those connected to regional pipelines in the western portion of the watershed, own private wells that tap into local aquifers.

Sand and Gravel Aquifers

The main groundwater sources within the region are found in glacial sand and gravel deposits consisting of lenses of coarse materials or major buried sand and gravel aquifers (Figure 9). These aquifers vary considerably in both thickness and extent throughout the watershed. For this reason, both groundwater supply and quality varies significantly. Principal sand and gravel aquifer depths range from seven to 30 metres, on average. Aquifers at depths from 30 to 60 metres also exist, but they are less common. Shallow, near surface sand and gravel aquifers less than seven metres in depth also occur but water yield and quality are more variable. They are also highly susceptible to groundwater contamination and drought effects.

SRRWD offers a well sealing and remediation program to reduce the potential risk of surface run-off contaminants directly entering groundwater. This program provides funding to seal abandoned wells and eliminate unsanitary well pits, thereby reducing contamination hazards to the well water system.

Groundwater from sand and gravel aquifers is the primary source of potable water for most rural residents and communities. Groundwater capacity and quality is good to excellent. Well yields are low to moderate, and range from about 10 to 225 liters per minute. Higher yielding wells, including artesian wells in the Rural Municipality of Piney area, may yield 450 to over 900 liters per minute. In the western reaches of the Roseau River Watershed towards the Red River, the yield and quality of water from sand and gravel aquifers decreases. Water becomes increasingly saline here as the amount of total dissolved solids in the water increases.

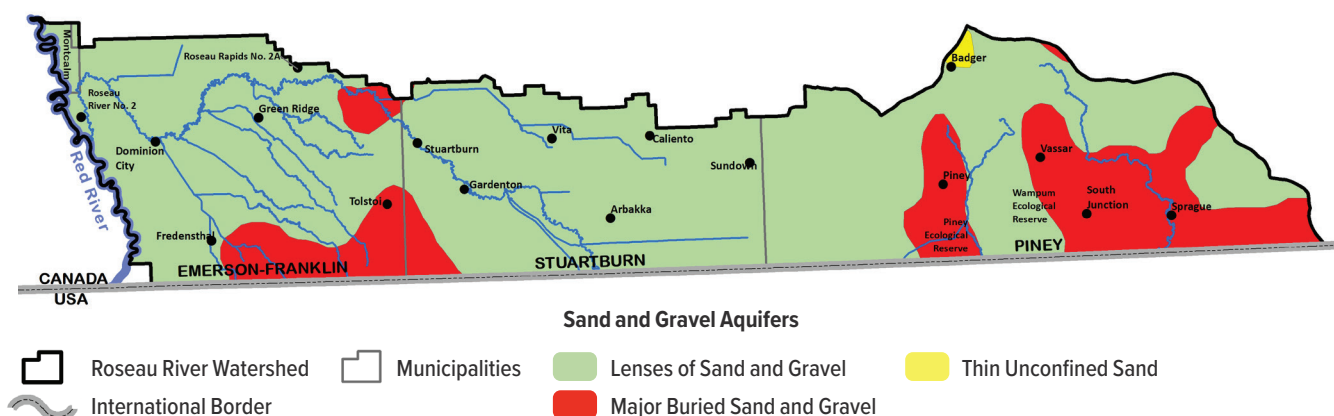


FIGURE 9: SAND AND GRAVEL LENSES, MAJOR SAND AND GRAVEL AQUIFERS, AND COMMUNITY WELLS WITHIN THE ROSEAU RIVER WATERSHED.

Limited information is available regarding groundwater recharge in the watershed. The Sandilands glaciofluvial complex is a major source of recharge for the underlying aquifers in southeastern Manitoba. It extends into a small portion of the Rural Municipality of Stuartburn and a large portion of the Rural Municipality of Piney. Lack of information about aquifer recharge, coupled with limited understanding of aquifer depletion in the Roseau River Watershed, limits the ability of local communities to plan for water supply into the future.

Bedrock Aquifers

Bedrock aquifers as the name implies are found within geological rock formations typically at greater depths than most sand and gravel aquifers. Bedrock formations within the Roseau River Watershed consist of carbonate rocks, sandstone and sand (Ordovician Winnipeg formation), limestone, sandstone, shale (Jurassic formations), and Precambrian rocks (Figure 10). The carbonate aquifer is the only bedrock aquifer within the watershed that is used as a groundwater supply with well yields ranging from about 20 to 340 liters per minute. The carbonate aquifer depth varies from approximately 15 to 91 metres throughout the watershed. Since the more accessible sand and gravel aquifers have adequate groundwater capacity and quality, carbonate aquifer use is limited. Many residents who have tapped into the carbonate aquifer often refer to the smell of sulfate minerals in the groundwater.

Water Use Licenses

There are 16 groundwater use licenses issued in the watershed for a total allocation of 333 cubic decameters, or 270 acre-feet. This limited allocation represents about 100 Olympic sized swimming pools and represents a very small proportion of the total available water in the watershed. The majority of water use licenses are issued for groundwater sources for agricultural livestock use and municipal use. There are two irrigation surface water licenses for a total of 96 cubic decameters or 78 acre-feet.



Photo credit: Justina Hop

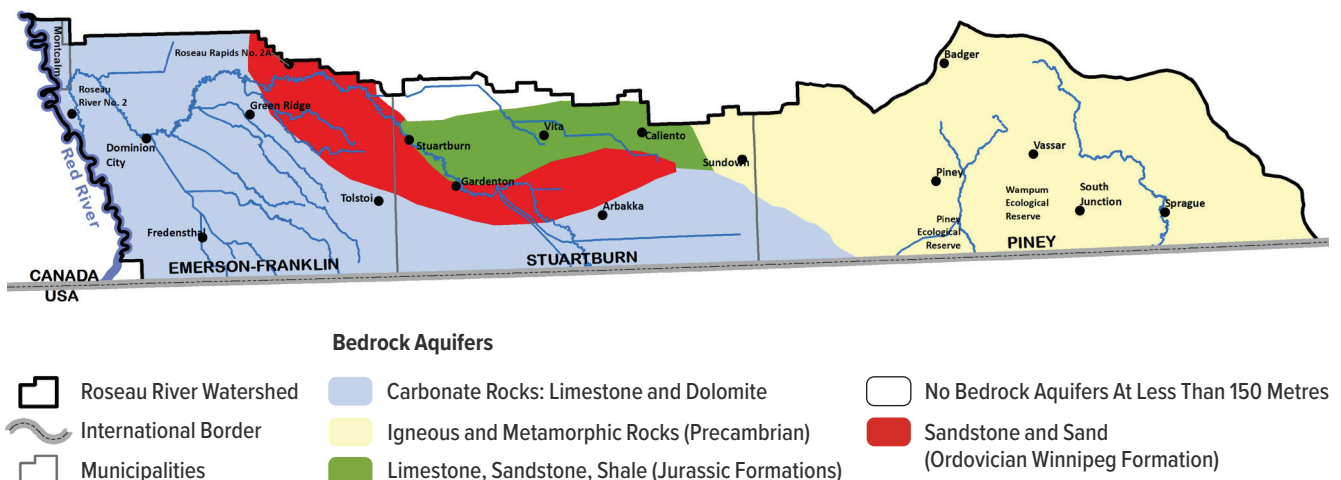


FIGURE 10: SAND AND GRAVEL AQUIFERS IN ROSEAU RIVER WATERSHED.

Surface Water Quality

A Watershed Overview

Manitoba Agriculture and Resource Development maintains one long-term water quality monitoring station in the Roseau River Watershed near Dominion City at PR 200. The station has been in operation since 1973 and water samples are tested four times each year. Samples are analyzed for a suite of parameters including general chemistry, nutrients, metals, pesticides and bacteria. Data from this long-term single sampling point provides an overview of surface water quality for the watershed before it enters the Red River.

Water Quality Index

The Water Quality Index (WQI) is used for reporting large amounts of water quality data in a consistent, easy to understand manner. It uses up to 25 variables to calculate a rating that combines the scope, frequency, and amplitude of water quality guideline exceedances. The WQI ranges from 0 to 100, from poor to excellent. Based on recent analysis, the water quality index (WQI) for the Roseau River monitoring station ranges from fair to good (Figure 11) — indicating that some variables occasionally did not meet water quality guidelines.

Dissolved Oxygen

Adequate dissolved oxygen is necessary for healthy aquatic life. Dissolved oxygen levels on the Roseau River have been consistently above the 5.0 milligrams per litre objective, indicating adequate oxygen is available with few exceptions. Low oxygen levels are not uncommon after a summer of intense algal blooms consuming oxygen from the water column. As well, low oxygen levels may develop under ice conditions in small prairie rivers as plant material decomposition consumes oxygen from the water and ice limits oxygen exchange with the atmosphere.

Nutrients

Phosphorus and nitrogen are necessary for plant growth, but can create costly problems when excess concentrations become present in waterways from a variety of point and non-point sources. Excess nutrients can contribute to algae blooms that can impair drinking water and interfere with recreational activities. Total phosphorus concentrations have increased in variability over time and are closely tied to flow. Many streams and rivers in southern Manitoba experience phosphorus levels above the 0.05 milligrams per litre objective, including the Roseau as shown in Figure 12. Total nitrogen concentrations have remained relatively constant through time and are generally above the narrative guideline of 1.0 mg/L.

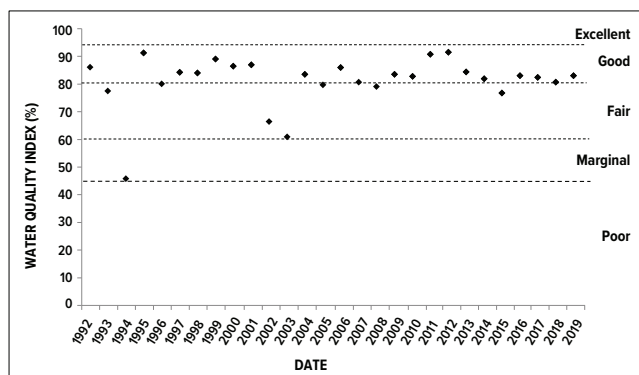


FIGURE 11: WQI CALCULATED FROM 1992 TO 2019 FOR THE ROSEAU RIVER AT DOMINION CITY STATION MB050DS032.

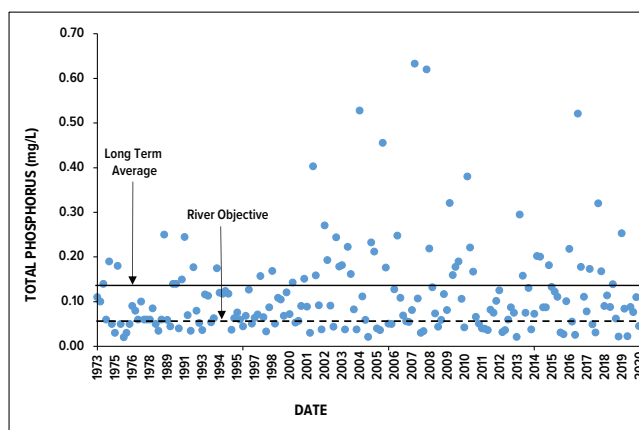


FIGURE 12: PHOSPHORUS CONCENTRATION IN ROSEAU RIVER (1973-2020) AT DOMINION CITY STATION MB050DS032.

Bacteria

E.coli and total coliform bacteria levels are indicators of water quality health, both for human consumption and recreational purposes. Most forms of coliform bacteria do not generally cause illness, but their detection in water—especially in large numbers—may indicate the presence of more harmful bacteria that elevate the risk of illness. Average annual *E. coli* values were well below the recreational objective of 200 *E.coli* per 100 millilitres from 2000 to 2020 on the Roseau River.

Pesticides

Pesticides were consistently below or very close to detection limits for all 91 pesticides monitored on the Roseau River. A total of 18 pesticides were detected; 2,4-D, 2,4-DP, AMPA, atrazine, bomoxynil, chlorothalonil, dicamba, fenoprop (Silvex), glyphosate (Roundup), imazamethabenz-me, MCPA, metasulfuron-me, pentachlorophenol, simazine, thifensulfuron methyl, thifensulfuron-me, tribenuron methyl and triclopyr. Of those 18 pesticides detected only four exceeded (i.e., didn't meet) objectives; 2,4-D, dicamba, mcpa and simazine. More specifically, the drinking water aesthetic objective was exceeded on four occasions for 2,4-D. Dicamba exceeded the irrigation objective on 25 occasions. The objective for aquatic life was exceeded three times and the irrigation objective 10 times for MCPA. Finally, simazine exceeded the irrigation objective on 2 occasions.

Community Monitoring Efforts

Water quality monitoring in the Roseau River watershed is also done through other organizations such as the South-Central Eco-Institute (Riverwatch) and the Lake Winnipeg Community-Based Monitoring Network (LWCBMN). Introduced in 2015, the LWCBMN initiative engages citizen volunteers to collect water samples across Manitoba using scientifically-vetted protocols to measure phosphorus concentrations. Through a network of watershed partners and citizen volunteers the program aims to identify phosphorus hot spots - i.e., localized areas that contribute higher amounts of phosphorus to waterways than other areas. The SRRWD is an active participant in the LWCBMN, collecting water quality samples in targeted locations

WATER QUALITY INFLUENCES

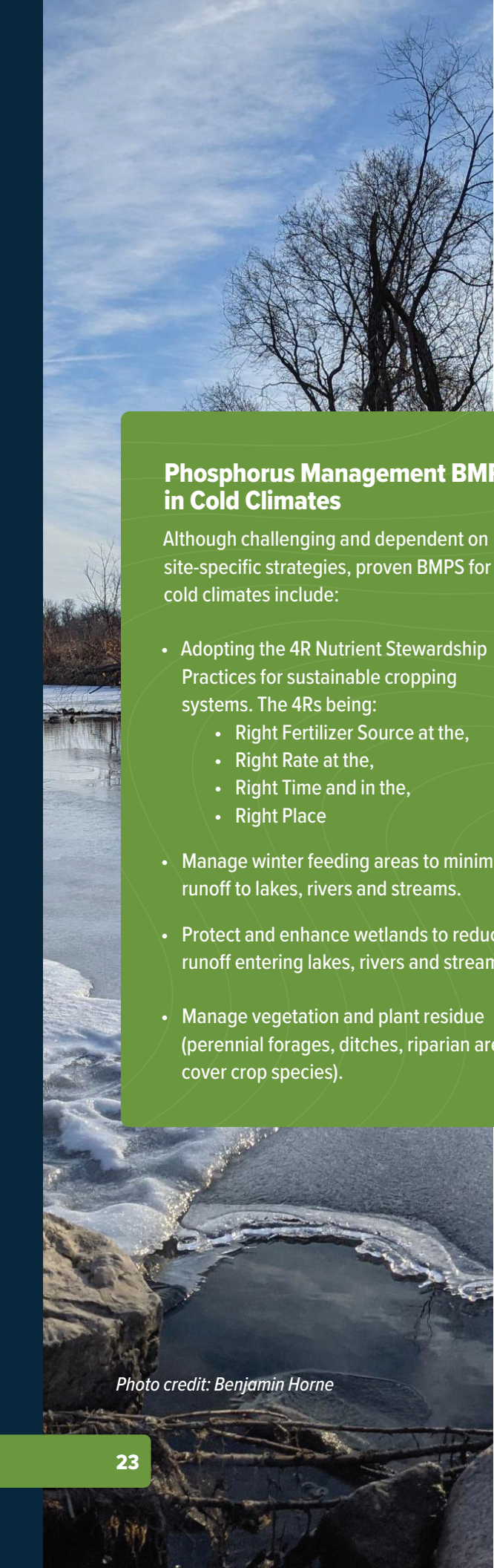
Nitrogen and phosphorus, sediments, and bacteria are substances that can impair water quality. Municipal wastewater can contribute high levels of nutrients and bacteria to waterways and water bodies. Agricultural, rural residential, and urban activities can also impair water quality if not managed properly.

Pesticides applied to crops, rights of way, ditches, lawns, and development sites can move into water bodies if not applied and managed properly.

Petroleum products and industrial waste from commercial, agricultural and industrial use can impair water quality if they are improperly handled, transported, used, and stored.

Strong, well thought-out municipal planning bylaws that support community, recreational and business development with watershed health in mind directly influence water quality.

Educational programs like Environmental Farm Plans, pesticide application and nutrient management courses, and youth education programs improve local knowledge and reduce risks to water quality.



Phosphorus Management BMPs in Cold Climates

Although challenging and dependent on site-specific strategies, proven BMPs for cold climates include:

- Adopting the 4R Nutrient Stewardship Practices for sustainable cropping systems. The 4Rs being:
 - Right Fertilizer Source at the,
 - Right Rate at the,
 - Right Time and in the,
 - Right Place
- Manage winter feeding areas to minimize runoff to lakes, rivers and streams.
- Protect and enhance wetlands to reduce runoff entering lakes, rivers and streams.
- Manage vegetation and plant residue (perennial forages, ditches, riparian areas, cover crop species).

Photo credit: Benjamin Horne

throughout the district including sites in the Roseau River Watershed. This data, combined with long-term Province of Manitoba water quality data, helps the SRRWD improve water quality awareness, identify sub-watersheds with high phosphorus concentrations and yields, and implement local programs and initiatives where needed most to improve water quality. The LWCBMN publishes yearly reports which can be found on their website. More information on these initiatives can be found at www.scecoinstitute.com and www.lakewinnipegfoundation.org/lake-winnipeg-community-based-monitoring-network.

Phosphorus Management in Cold Climates

Phosphorus in runoff can be attached to eroded soil particles (a minor source in Manitoba) or dissolved from the following sources: (i) surface soil, (ii) surface-applied or incompletely incorporated fertilizer and manure; and (iii) enhanced release from vegetation and crop residue due to freeze-thaw cycles, unique to cold climates (and a major Manitoba source). Frozen soils during spring runoff also contribute to phosphorus losses by reducing infiltration and the potential for the soil to reclaim dissolved phosphorus as it moves through the landscape.

The release of readily-soluble phosphorus from plant residues on landscapes, which in turn are easily picked up and carried by spring and summer runoff, makes phosphorus very challenging to manage. Many recommendations to control phosphorus come from research in warmer jurisdictions where soil erosion has been the primary phosphorus loss pathway and frozen soils and freeze-thaw cycles do not contribute to phosphorus runoff. Thus, beneficial management practices (BMPs) implemented there may not be as effective in northern landscapes like Manitoba.

Surface Water Quality - Findings within the Watershed

Within the Roseau River Watershed, water quality varies greatly from east to west. In the eastern upland or headwater area there is limited agricultural activity, many wetlands and large forested areas. The combination of these factors has resulted in good water quality in both the Sprague and Pine Creek systems. Total phosphorus levels were detected below 0.05 milligrams per litre during most sampling periods (SRRWD sampling 2014-2020).

The Vita Drain begins near the community of Sundown and runs west until it meets the Roseau River near the Town of Roseau River. Water quality tests in this drain have shown fewer nutrients than the main stem of the Roseau, thereby helping to dilute the nutrient load coming from upstream sources. The low level of nutrients and sediments in the Vita Drain is likely due to the predominance of wetlands and pasturelands throughout its drainage basin.

In contrast, the network of drains that span the western portion of the watershed where agriculture predominates on the fertile lacustrine deposits tends to feed water with higher levels of phosphorus to the main stem of the Roseau. For example, phosphorus levels in the Main Drain have exceeded provincial recommendations by up to six times the recommended limit. Monitoring of other drains in this area is not currently feasible due to resource limitations.

Roseau River water quality runs along a gradient from east to west. Once the river crosses into the Red River valley portion of the watershed, there are notable increases in turbidity, phosphorus and dissolved solids. This trend is likely due to changes in soil type and land use as sandy pasturelands and undrained wetlands and forests in the east give way to clay based agricultural lands with an extensive drainage network in the west.

Benthic Macroinvertebrate Monitoring and Regular Water Sampling

Benthic macroinvertebrates are small, spineless creatures that live on the bottom of waterways. These creatures include beetles, leeches, worms, snails and many juvenile



insects (for example, mayfly nymphs, dragonfly nymphs, stonefly nymphs and some fly larvae) that are large enough to be seen with the naked eye. They do not include amphibians (frogs and salamanders), reptiles (turtles), fish or other large animals.

By identifying which are present and, often more importantly, which are absent from waterways, comprehensive benthic macroinvertebrate monitoring can help assist in determining waterway health trends over time. Benthic macroinvertebrate monitoring consists of collecting representative samples of invertebrates that live in a waterway and comparing the number and types found to those expected to be found in a similar environment that is in pristine condition. To ensure all data collected are credible and comparable, Seine Rat Roseau Watershed District follows the nationally recognized protocols established by the Canadian Aquatic Biomonitoring Network (CABIN). Although benthic macroinvertebrate sampling only needs to be conducted once every few years, the SRRWD monitors multiple waterways throughout the watershed on a regular basis. This monitoring is conducted in conjunction with two separate sampling efforts: Lake Winnipeg Community Based Monitoring Network (Lake Winnipeg Foundation) – which focuses primarily on phosphorus and South Central Eco Institute’s “Riverwatch” program – which focuses on multiple chemical parameters as well as engaging students and schools to become involved in monitoring efforts. More information can be found at: <http://srrwd.ca/awareness/backwater-buggin-for-healthy-waterways/>.



Biodiversity and Natural Areas

Natural habitat is critical for supporting the integrity of our land and water ecosystems. Diverse plant and animal communities flourish in aquatic and terrestrial habitats like forests, wetlands, riparian areas, and grasslands throughout the watershed. These existing natural areas, whether on private, municipal, or provincial lands, provide key habitat for a wealth of diverse plant and animal species. These same areas and landscapes also provide tremendous value and enjoyment to outdoor enthusiasts, naturalists, home owners, and land owners. Species-at-risk are present throughout the watershed, including both aquatic and terrestrial species.

Wildlife Management Areas (WMA) and Provincial Forests in the Roseau River Watershed include the Stuartburn and Spur Woods WMAs, the Cat Hills Provincial Forest, and portions of the Sandilands, Wampum and Northwest Angle Provincial Forests. All four provincial forests are located on the eastern side of the watershed on provincial Crown land. These forests are important for tourism and support recreational opportunities for nature enthusiasts, hikers, ATV riders, snowmobilers, hunters, skiers, horseback riders and others. They provide key habitat to a diversity of plants, animals and insects, some of which are very unique and rare. Animals within the region include moose, elk, white-tailed deer, black bear, fox, coyotes, wolves, lynx, numerous smaller animals and a variety of birds. This area is also well known for wild mushroom, blueberry, Saskatoon berry, and cranberry harvesting.

Roseau River Watershed contains several significant protected natural areas (Figure 13):

Wampum Ecological Reserve is found within the Sandilands Provincial Forest in the headwaters of the watershed. This reserve protects a mixed wood forest typical of the St Lawrence-Great Lakes Region and in particular, the western limits of mature red pine. The reserve is 62 hectares in size. The scarlet tanager, a rarely observed bird, has been spotted here.

The **Piney Ecological Reserve** is located just southeast of the town of Piney. It is a large wetland complex with diverse wetland types. The wetlands, forests and mature cedar bogs found in this part of the watershed provide habitat for species like the mottled dusky-wing (a rare skipper butterfly), uncommon large white-flowered ground cherry, wild ginger, the great grey owl, and many other plants, animals and insects. These protected lands are free from industrial or commercial resource harvest such as logging, mining, oil and gas, and peat. Protected lands are also free from any agricultural, recreational or commercial development and are intended to be left in their natural state.

Ecological reserves play a key role in Manitoba's Protected Areas Initiative by protecting unique, rare and representative examples of plants, animals, geological features and ecosystems. They are the most protected of the provincially designated sites within Manitoba's network of protected areas. These sites are set aside for ecosystem and biodiversity preservation, research, education and nature study. They are not intended to be recreation, resource harvest or multiple-use areas. In comparison, provincial crown lands are considered as multi-use lands, thus supporting a range of potential activities such as forestry, agriculture, recreation, sport hunting, tourism and more depending on designation.

The **Manitoba Tallgrass Prairie Preserve** is also found in the Roseau River watershed in the municipalities of Emerson-Franklin and Stuartburn. Management of the Tall Grass Prairie Preserve is governed by an MOU among its partners: Manitoba Agriculture and Resource Development, Nature Conservancy of Canada, Nature Manitoba, Manitoba Habitat Heritage Corporation and Environment and Climate Change Canada. Representatives from these agencies serve on the Preserve's management committee. The preserve contains about 4,000 hectares (9,900 acres) of tallgrass prairie, aspen parkland, and wetlands. This preserve is a remnant area of the vast tallgrass prairie landscape once common to the wetter eastern grasslands region of United States and Canada prior to plowing upon arrival of European settlers to North America. Specifically, the preserve is part of the Northern tall grasslands ecoregion, which largely follows the Red River Valley in Manitoba, North Dakota and Minnesota. Tallgrass prairie is home to some of the deepest and most fertile soils left after glaciation, and supports significant biodiversity. Dominant grasses included big bluestem, switchgrass and indiagrass. Trembling aspen and bur oak are very common in the wetter transitional grasslands-forest areas. Due to expansion of agricultural land use, estimates suggest only between 1 to 4% of the original tallgrass prairie exists today in North America. Over half of global population

of endangered western prairie white-fringed orchid occurs here. Other rare species include the small white lady slipper and the poweshiek skipperling, a butterfly species found only in the Preserve area within Canada.

Riparian Areas and Wetlands

Riparian areas are the transitional zones found along waterways, lake shores, and wetlands. They connect land to water and provide critical ecosystem functions, including slowing water flow, reducing bank and shoreline erosion, trapping sediment, and filtering surface runoff. They build climate resiliency in the watershed by moderating flood and drought events. They also provide bank storage of water and important pools during low flow or short-term droughts.

SRRWD offers riparian programming to assist livestock owners with installation of alternative watering systems and riparian fencing. The goals of the riparian program are protection and restoration of areas along water bodies in an effort to reduce stream bank erosion, enhance riparian habitat for wildlife, improve water quality and improve herd health.

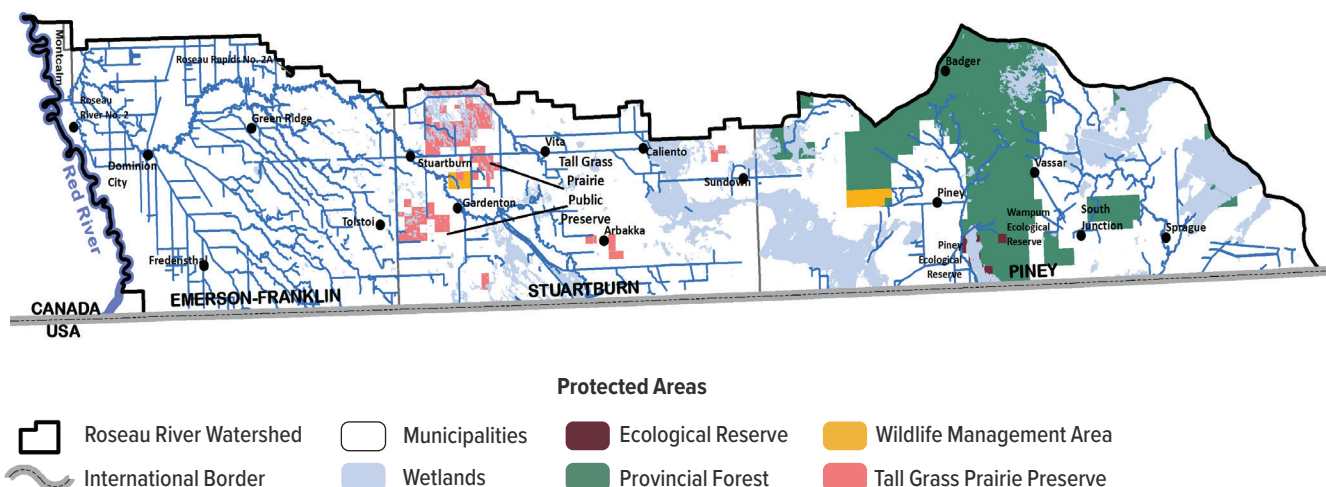


FIGURE 13: PROVINCIAL FORESTS, ECOLOGICAL RESERVES, AND WILDLIFE MANAGEMENT AREAS IN ROSEAU RIVER WATERSHED.

Healthy riparian areas contain a mixture of trees, shrubs, grasses and aquatic plants. This diversity in flora helps support a variety of species of wildlife including mammals, birds, fish, insects and aquatic invertebrates. Riparian areas also provide important travel corridors that are critical for wildlife species in agriculture-dominated landscapes.

Within the Roseau River Watershed, most riparian areas in the upper reaches of the basin are largely left intact and functioning well. The diversity of plants and animals is high. In contrast, species diversity is much lower in the downstream reaches of the watershed where riparian areas are primarily located on private property under agricultural production. Economic pressures and management practices in the western portion of the watershed limit riparian area size, preservation, and function.

Like riparian areas, wetlands provide ecological goods and services for the watershed. They capture and store water, contributing to water availability, filtration, and purification. Wetlands also provide climate change adaptation benefits such as enhanced carbon storage for greenhouse gas mitigation. They also

Wetlands are one of the most productive and threatened ecosystems supporting more than one third of Canada's species at risk. The Roseau River Watershed is home to over 3 dozen species at risk. Management of working lands can be challenging in areas that support species at risk habitat, especially where development pressures are on the rise.

The Roseau Watershed contains a significant fish community – most of which is encountered by people in the lower section of the watershed. Small bodied fish species in the upper watershed are important in the food chain for many other species.

provide valuable fish and wildlife habitat, recharge groundwater, and moderate flood and drought events. The upper and middle reaches of the Roseau River Watershed are home to many bogs, marshes, and swamp complexes that cover significant areas of land.

Forestry and Peatlands

Forestry

There is a transitional zone around the mid-point of the Roseau River Watershed where the landscape changes from primarily agricultural lands intermixed with forest, to primarily forest with pockets of agricultural lands. Wetlands also become more prevalent in the middle to eastern portions of the watershed. Overall, forest covers 32% of the Roseau River Watershed. The watershed is primarily forested in boreal species in the east and progresses to prairie dominated lands with river-bottom forest conditions in the western part of the watershed. Common forest tree species include trembling aspen (poplar), birch, maple, oak, ash, willow, spruce and pine. The forest lands in the watershed include representation from the Aspen Parklands, Boreal Plains and Great Lakes St. Lawrence forest conditions. This includes portions of the Sandilands and Northwest Angle Provincial Forests as well as all of the Cat Hills and Wampum Provincial Forests. All Provincial Crown Land including Provincial Forests in the watershed are managed for forestry purposes and are part of the annual allowable cut calculations for Forest Management Unit 24.

There is a long history of forest management activities in this area dating back to the late 1920s. Harvesting and natural renewal occurred before this time as settlers started to develop the lands in the 1800s. Early settlers used lumber for homestead purposes and in time began to market lumber to areas beyond home. Today, more modern forest harvest companies extract lumber both on Provincial Crown and private lands under permit from Manitoba's Forestry and Peatlands Branch. Manitoba's Forestry and Peatlands Branch issues permits to harvest boughs and tops for seasonal decoration.

Forest management activities are regulated by a series of provincial acts, regulations and guidelines, as well as industry-directed forest management plans, policies, procedures and standard operating guidelines. The provincial guidebook entitled “Forest Practices Guidebook: Forest Management Guidelines for Riparian Management Areas” sets standards for sustainable forest management practices adjacent to riparian and aquatic systems in permitted zones. Harvest practices are permitted, restricted or prohibited in different riparian zones depending on site conditions and distance to riparian areas. Social and traditional values, water quality, fish habitat, soils, wildlife, and forest health are taken into consideration in the development of a riparian zone. The Boreal Wetlands Conservation Codes of Practice are also a good resource and can be found at https://www.gov.mb.ca/forest/pubs/forestry_peatlands/boreal_codes_practice.pdf

Harvest operations in the watershed are designed to follow forest practices guidelines and are inspected to ensure compliance with these requirements. Required water quality buffers are established along waterways. Typically water crossings are completed in frozen conditions with winter crossing structures. Renewal typically occurs within two to five years post-harvest disturbance. Forest renewal strategies for harvested areas take into account sustainable practices and costs.

The guidebook also outlines a number of best management practices that can be used by forest planners and logging supervisors when working around sensitive water features.

The sustainable and careful management of both upland forests and riparian forests play a large role in protecting the health of watersheds in Manitoba. Between 1992 and 2001, the Manitoba Forestry Association developed woodlot management plans for woodlots in the Rural Municipalities of Emerson-Franklin (15 plans), Piney (46 plans), and Stuartburn (16 plans).

Best Management Practices for Operating Near Water Bodies

1. Remove only merchantable timber.
2. Retain all shrub understory, non-merchantable and immature timber.
3. No operation of machinery within identified Machine Free Zones.
4. Slash must not be deposited in streams or on stream banks.
5. Timber must be felled away from the stream, not across.
6. Road development near riparian areas must refer to Forest Practices Guidelines Forestry Road Management.
7. Where it is necessary to cross a stream, a designated crossing established perpendicular to the stream must be used.
8. Crossings are removed in accordance with Manitoba guidelines once access is no longer required.
9. Soil disturbance in a riparian area requires temporary and permanent erosion and sediment control measures.

Peatlands

Peatlands are wetlands that have accumulated peat on their surface. Peat is made up of decomposed plants (usually sphagnum moss) that resemble a compost-like organic material. It forms in poorly-drained areas with low-oxygen (anaerobic) levels and takes thousands of years to form in nature. Peat is used extensively in the horticultural industry as an organic amendment and growing medium for mushrooms, fruits and vegetables, forestry seedlings, flowers and bedding plants, gardens, lawns and vegetative landscaping. Other uses include an eco-friendly absorbent to clean up hydrocarbon spills both on land and at sea, as an air bio-filtration medium, and as a bio-filter in wastewater treatment systems.

Manitoba contains about 17% of Canada's peatlands covering 19.2 million hectares, almost a third of the province. The vast majority of peatlands are found in mid to northern Manitoba with the exception of a zone which extends down the eastern side of the province into the Roseau River Watershed right to and beyond the Canada-US border.

The Peatlands Stewardship Act sets out development and management regulations and is part of Manitoba's Peatlands Stewardship Strategy. Peat harvest occurs near the community of Sprague and although most development is outside the watershed, a processing plant near Vassar is an important local industry. Future development may be a possibility and is a concern for area residents. Local concerns include alterations to habitat for wildlife, loss of greenhouse gas sinks for carbon sequestration, and loss of ecological goods and services, including drought and flood mitigation, water purification and base flow contributions to streams. As land drainage is part of commercial development of peatlands, surface water management issues are part of these concerns.

There are two peat harvest licences within Roseau River Watershed; however, neither company has initiated development.

Roseau River Watershed Distributed Retention Study

Achieving reductions in peak flows on streams and tributaries throughout the Roseau River Watershed is a key action to address surface water management challenges. Water retention and storage builds climate resiliency in the watershed and is an important part of mitigating the impacts of extreme events. Crop, property and waterway infrastructure damage, field and streambank erosion, siltation of major drains and waterways, road closures and property access are just a few of the key issues faced in the watershed during high runoff events. Collectively these issues create additional costs and hardships on residents, landowners, businesses, municipalities, and the provincial and federal governments. There are also impacts on water quality, recreation and aquatic habitat, both locally and further downstream.

Agriculture and Resource Development (Surface Water Management Section) worked with the Seine Rat Roseau Watershed District to initiate a distributed water retention study for the Roseau River Watershed. The study provided a conceptual engineering analysis to determine a strategic plan to implement water retention in the watershed by:

- Providing general hydrology information of the watershed,
- Summarizing previous reports and plans to identify surface water issues such as water supply, excessive moisture and flooding, and water quality,
- Identifying potential water retention study sites and propose possible projects, and
- Evaluating the potential local and basin scale flow reductions water storage projects would achieve.

This study mirrors efforts in the USA by the Roseau River Watershed District with funding from the Red River Watershed Management Board. Analyses were completed using the hydrologic modeling system (HEC-

HMS model), a software program designed to simulate precipitation and runoff processes in a watershed. Engineers in the USA determined the volumes of storage required in tributaries like the Roseau River to help achieve the Red River Basin Commission's goal of 20% peak flow reduction for a 100-year flood event on the Red River.

In Canada, eight potential storage retention sites were selected for a preliminary assessment including a conceptual design, storage capacity, potential benefits,

and costs. Input was received from the Seine Rat Roseau Watershed District, municipal representatives, and from the Surface Water Management Section of Manitoba Agriculture and Resource Development. A field tour of these sites was combined with the hydrologic modeling performed on each site to simulate 10-year and 100-year flood events. A summary of project details is provided in Table 3.

The distributed retention study results identify real opportunity to achieve peak flow reduction through

PROJECT NAME	ZONE	MAX STORAGE CAPACITY		DRAINAGE AREA (km ²)	DEPTH OF RUNOFF RETAINED (mm)
		DAM ³	ACRE FEET		
Horseshoe Lake	C	10,200	8,269	66.1	154
Sundown Ridge	C	6,000	4,864	90.98	66
Gardenton Floodway-Community Pasture	B	55,000	44,589	66.3	758
Tolstoi	B	4,600	3,729	29	159
Kirkpatrick Swamp	B	5,000	4,053	47.8	105
Senkiw Dam	B	7,100	5,756	4650	1.5
Sprague Creek	D	45,000	36,482	139	324
Somme Swamp	C	26,000	21,079	167.6	6.1

TABLE 3: DISTRIBUTED WATER RETENTION SITES IN THE ROSEAU RIVER WATERSHED

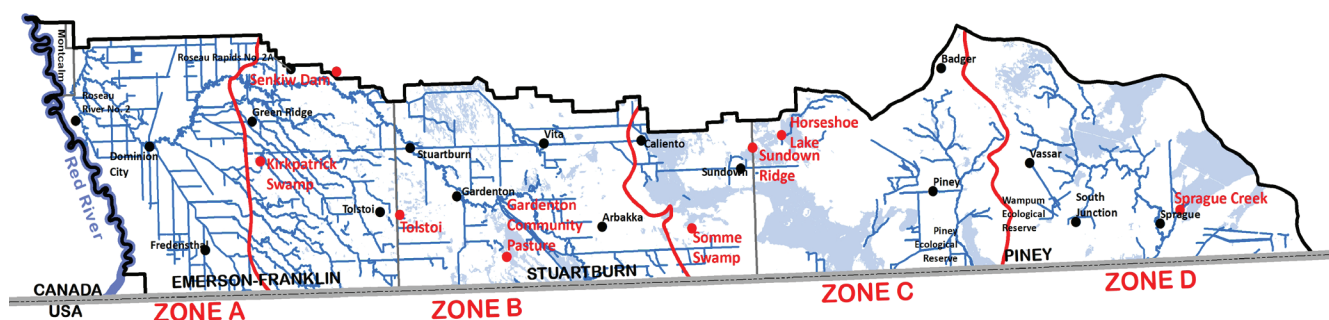


FIGURE 14: DISTRIBUTED WATER RETENTION STUDY PROJECT LOCATIONS IN THE ROSEAU RIVER WATERSHED.

strategically placed water retention (catch and release) projects. Main channel flow reduction benefits at the downstream end of the watershed by Dominion City for the first peak (early spring) runoff event were calculated close to 30% in both 10-year and 100-year return periods when results for all ten projects were collectively combined. This exceeds the Red River Basin Commission's Long-Term Flood Solutions Basin-wide Flow Reduction goal of 20%.

Significant reduction in peak flow could also be achieved for the second flood peak on the Roseau River, although lower than the first. For the late spring or what is termed the second flood peak event on the main channel, combined peak flow reduction benefits for all ten projects were calculated to be 7% in 10-year and 13% in 100-year return periods. By the second peak the onset of spring is further along and the entire watershed is more hydrologically active as melt waters gather from all areas. Large fluctuations in day-time and night-time temperatures are common in the early spring runoff peak, and typically lessen later in the season, resulting in more sustained flow over time. If water retention areas are at capacity from the first peak, then they are unable to drain down in time to hold more water later on.

When analyzing individual project benefits, the distributed retention study shows peak flow reduction ranging from a low of 54% to a high of 100% for 10-year events, and a low of 46% to a high of 98% for 100 year flood events for seven out of the eight proposed sites. Three proposed sites had no flood reduction benefit. These numbers indicate that significant flood reduction benefits could be achieved locally in the near downstream vicinity of these projects. The benefits would dissipate further downstream as tributaries and flow from other sub-basins feed into the system.

In addition to exploring opportunities for large-scale water retention projects, smaller retention sites with less storage volume continue to be implemented by the Seine Rat Roseau Watershed District. These sites help reduce peak flows in the immediate area and to a lesser degree downstream. Peak flow reduction benefits can be magnified when a network of such

structures are targeted on a smaller sub-watershed basis, such as in the upper reaches of the Roseau River Watershed. However, added benefits such as localized water management capacity, drought resilience, nutrient management and erosion control often make small scale projects worthwhile at the local scale. All water retention projects are implemented using a combination of LiDAR-based technologies and must receive all necessary approvals prior to construction (including, for example, approvals related to The Environment Act, The Water Rights Act, etc.). In addition, the Mapleleaf Mussel, a species listed under federal and provincial endangered species legislation, is present in the Roseau River, and may impact approval of water storage projects near the mainstem Roseau River. Seine Rat Roseau Watershed District continues to work with its partners to develop a targeted approach to flood risk reduction.

The full Roseau River Watershed Distributed Retention Study report can be found at SRRWD.ca.



Photo credit: Sandra Drewniak

Roseau River Watershed Drought Preparedness Study

Droughts of various degrees and length have appeared in the past and will inevitably return. Climate models and long-range forecasts from the Prairie Climate Centre indicate that southern Manitoba will experience an increase in the number of days greater than 30 degrees C and reduced water availability. The last significant drought in Manitoba occurred in 1988 when crop yields were minimal, wind erosion filled many ditches with topsoil, lawns looked dead, and water shortages were experienced. The 1988 drought was less severe in comparison to longer more sustained droughts like those experienced in the 1930s.

Manitoba's Drought Management Strategy states that being prepared for the onset of drought is the most desirable and proactive means to manage drought, and provides guidance on drought preparedness and response for local governments and water supply providers. For example, the Pembina Valley Water Cooperative (PVWC), which supplies water to the RMs of Emerson-Franklin and Montcalm, developed a drought plan in 2018. Linking drought preparedness assessments to this watershed plan will improve overall coordination and planning for future drought concerns.

Manitoba Agriculture and Resource Development completed a Drought Preparedness Study of the Roseau River Watershed in 2017 as a means to help understand and adapt to climate change. Key goals of the study include an inventory and understanding of the watershed's vulnerabilities to drought and assessing the watershed's preparedness to mitigate future impacts of drought.

The study analyzed the frequency and severity of past droughts and quantified the impacts to watershed residents, the local economy, and the local environment. Factors taken into consideration include drought monitoring networks, current and future water usage, water source reliability, socio-economic conditions, government policies, programs and regulations, and existing communication networks. A summary of drought impacts on water supply, agriculture, forestry and grasslands can be found on the following pages.

The full Roseau River Watershed Drought Preparedness Study report can be found at SRRWD.ca



Local observations of drought impacts vary across the watershed. Drought conditions increase the risk of forest fires in the eastern parts of the watershed, grass fires in central areas, and impact shallow wells in western portions of the watershed.

Key Drought Implications for Roseau River Watershed

WATER SUPPLY (domestic, municipal, industrial use)			
CONDITION	DROUGHT IMPACT	IMPLICATIONS	COMPOUNDING FACTORS
Majority of residents rely on groundwater. In some areas, residents rely on shallow wells from sand and gravel aquifers	Reduced aquifer recharge and lower water tables	Potable water shortages, especially for those who rely on shallow wells	Reduced groundwater recharge through changes in land cover and use Lack of water conservation measures and technologies by end users or providers
Surface water flows feed water supply to water treatment plants which serve residents in the Rural Municipality of Montcalm, Dominion City (and surrounding area), and Roseau River First Nation	Reduced surface water flows in Roseau River and tributaries feeding the Red River	Potable water shortages	Reduced baseflow to streams through loss of wetlands and riparian areas, excessive drainage, changes in land cover and use Lack of water conservation measures and technologies by end users or providers

TABLE 4A: KEY DROUGHT IMPLICATIONS FOR THE ROSEAU RIVER WATERSHED - WATER SUPPLY.

AGRICULTURE			
CONDITION	DROUGHT IMPACT	IMPLICATIONS	COMPOUNDING FACTORS
30% of land use is dryland agriculture	Water deficits for crop and livestock feed production	Crop yield reductions or failures, feed supply shortages for livestock	Loss of water holding capacity of soils due to organic matter loss, lack of irrigation in the watershed, climate change bringing hotter, drier and longer growing seasons
	Land degradation - soil erosion, organic matter loss	Lack of surface residue to trap and conserve moisture and prevent erosion	Intensive tillage practices, low residue crops in rotations, other soil management practices
	Decline in pasture forage growth	Reduced carrying capacities for grazing livestock	Grazing management practices
	Riparian and vegetative buffer degradation	Increased pressure on riparian areas as feed source	Uncontrolled access to riparian areas
Grazing livestock utilize surface water sources	Reduced surface water availability	Water shortages for livestock	Grazing management and livestock watering practices
	Wetland and water quality degradation	Increased pressure on wetlands and riparian zones as source of water	Uncontrolled grazing access
Large livestock operations rely on groundwater	Reduced aquifer recharge and declining groundwater reserves	Water shortages for animals and operational requirements like cleaning	Increased demand for water with increased livestock numbers, lack of water conserving technologies, type of feed stocks used

TABLE 4B: KEY DROUGHT IMPLICATIONS FOR THE ROSEAU RIVER WATERSHED - AGRICULTURE.

FORESTRY			
CONDITION	DROUGHT IMPACT	IMPLICATIONS	COMPOUNDING FACTORS
Large areas of forests in watershed	Reduced mature forest growth	Less timber	Timber harvest practices
	Reduced forest rejuvenation post harvest	Longer recovery times	Reforestation efforts/plans
	Forest die-back	Increased fuel for forest fires	Insect and disease pressure on weakened forest
	Forest and species loss	Loss of habitat	

TABLE 4C: KEY DROUGHT IMPLICATIONS FOR THE ROSEAU RIVER WATERSHED - FORESTRY.

GRASSLANDS AND NATURAL AREAS			
CONDITION	DROUGHT IMPACT	IMPLICATIONS	COMPOUNDING FACTORS
Large areas of grasslands and natural areas in watershed	Dry and parched grasslands	Loss of habitat	Grassfires
	Wildfires	Increased fuel for wildfires	Irresponsible human activity
	Reduced water availability for flora and fauna	Loss of critical habitat, plants, and wildlife	Insect and disease pressure on weakened plants
	Reduced water levels in streams and wetlands	Reduced fish stocks and aquatic species	Fishery management practices
	Inadequate flows or water for recreational activities	Inadequate flows or water for recreational activities	Competing water usage needs

TABLE 4D: KEY DROUGHT IMPLICATIONS FOR THE ROSEAU RIVER WATERSHED - GRASSLANDS AND NATURAL AREAS.

Watershed Priorities

Early in the planning process, public meetings were held throughout the watershed to identify the concerns and values of watershed residents. This local input was combined with information provided by municipal, provincial and federal experts, and stakeholders to develop **Watershed Priorities** for the watershed, **Goals** to coordinate action on the ground, and **Actions** to achieve these goals.

PRIORITY AREA ➡ GOALS ➡ ACTIONS

Four Watershed Priorities emerged:

1. Surface Water Management

2. Groundwater Quality and Quantity

3. Surface Water Quality

4. Ecosystem Health and Natural Areas

Watershed priorities and goals in this watershed plan can only be reached if specific, achievable actions are implemented by each of the watershed's partners. Partners and lead organizations include the Seine Rat Roseau Watershed District, local, provincial and federal governments, landowners, and other stakeholder groups. The goals and actions identified on the following pages provide a framework for coordinating action on the ground, targeting actions to achieve priority outcomes and building partnerships to achieve success.

The Seine Rat Roseau Watershed District will lead the implementation of this plan by: nurturing existing and developing new partnerships, aligning district programming with the priorities, goals, and actions identified, and seeking new and innovative stewardship practices, sources of technical expertise and funding. This plan will only be successful if all partners play a role in its implementation. Progress of implementation will be monitored by the Seine Rat Roseau Watershed District over the ten year lifespan of this plan.



Photo credit: Sandra Drewniak



Photo credit: Georges Beaudry

An aerial photograph of a river winding through a lush, green forest. The river is dark blue, and the surrounding land is covered in dense trees and vegetation. The image is positioned on the left side of the page, with a green overlay on the right.

Implementation Plan

Priority 1: Surface Water Management

WATERSHED-WIDE GOAL:
Adopt a balanced, integrated and watershed-based approach to surface water management.

Local surface water management typically refers to the management of water to reduce or prevent flooding of agricultural, industrial and residential land. Although surface water is managed to protect infrastructure from overland flooding and to remove excess moisture from agricultural lands as quickly as possible, these benefits may be outweighed by unforeseen and unintended consequences on downstream people, property, and aquatic ecosystems. A holistic approach to surface water management considers multiple benefits, aquatic ecosystem health, water quality, climate change resilience, and downstream impacts to infrastructure and property.

Surface Water Management Zones

The Roseau River Watershed is characterized by a number of features that present distinct challenges for surface water management. To target actions and align them with the local landscape and issues, the watershed has been divided into four zones, each with its own surface water management challenges and priorities (Figure 15).

Zone A - Emerson - Dominion City Flats

This zone includes the portion of the watershed where the Roseau River flows through high valued cropland into the Red River. The area is the former lake bed of glacial Lake Agassiz and thus very flat. Areas close to the Red River and along the Roseau River main channel are especially subject to overland flooding or inundation when runoff exceeds the capacity of the main channel. The landscape is predominately under annual crop production due to the deep, fertile lacustrine soil, often with grains, oilseeds and legumes grown in rotation. A significant drain and ditch system has been developed throughout this zone to help manage surface water runoff and support annual crop production.

This surface water management plan was developed in an effort to bring a holistic and watershed-based approach to surface water management in the Roseau River Watershed.

Water retention and strategic surface water management strategies would benefit this zone. Programs and practices to enhance riparian areas and buffer strips will improve watershed health.

Key Challenges

- The flat topography of the Emerson-Dominion City Flats coupled with its downstream location in the watershed make the area susceptible to damage caused by significant rainfall and runoff events. Heavy clay soils dominate the landscape and limit soil moisture infiltration. Soils are easily saturated and the capacity of ditches, drains and streams are often exceeded during significant precipitation events resulting in overland flooding, crop and property loss, and road or

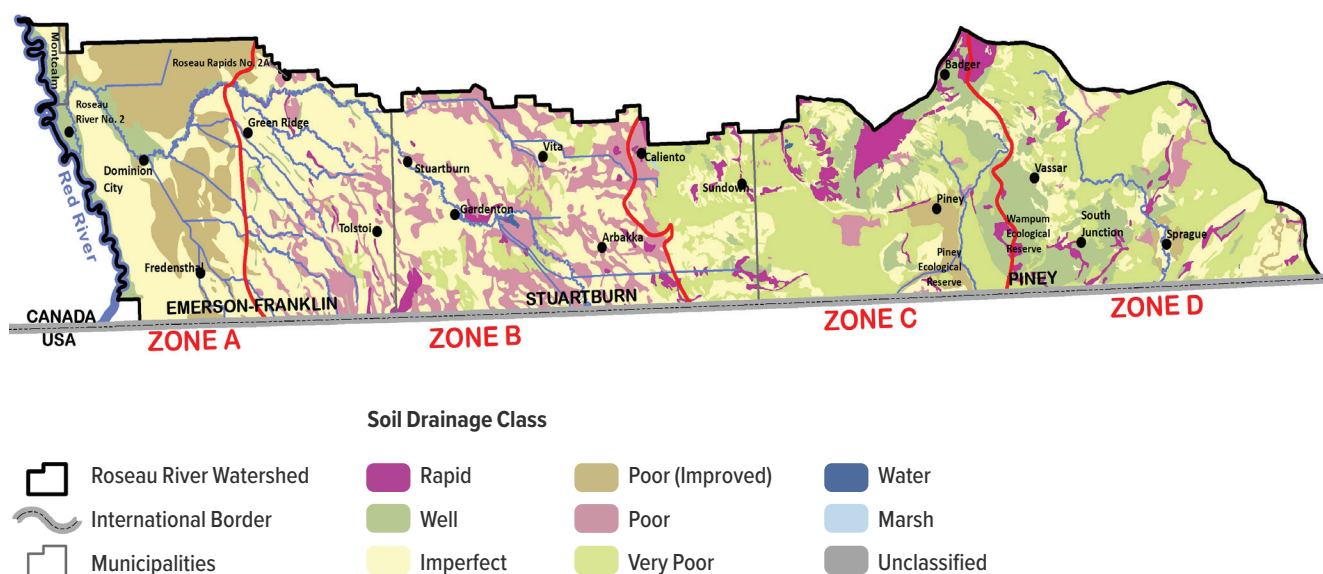
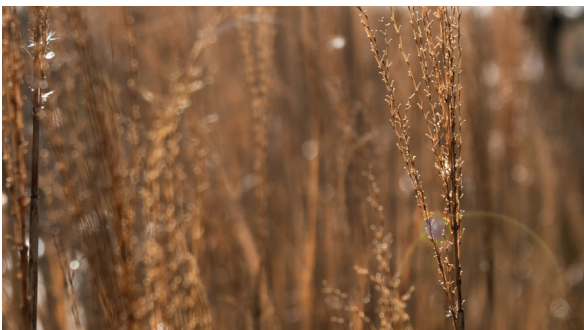


FIGURE 15: SURFACE WATER MANAGEMENT ZONES IN THE ROSEAU RIVER WATERSHED.

property accessibility issues. Overland flooding and saturated soil conditions negatively impact agricultural production, local infrastructure, and property.

- High land values and competition for agricultural land has led to land clearing and cropping encroachment over the years along the main stem and tributaries feeding into the Roseau River. Riparian areas have been narrowed and often totally removed, diminishing the many benefits healthy riparian areas provide.
- Lack of adequate buffers along provincial and municipal drains and ditches has reduced water filtration capabilities. This weakens the ability to control flowing water, diminishes wildlife habitat and biodiversity, and impacts the aesthetic and recreational value of the river itself.
- Lack of water retention, flooding of the Roseau River and backup from the Red River results in damage to municipal infrastructure, agricultural production losses, and property access issues.
- Water erosion and sedimentation within field, municipal and provincial drains impedes drainage and increases maintenance requirements.
- Streambank erosion on rivers, creeks and tributaries has resulted in property damage, reduced ability to contain water in the main channels, sedimentation in waterways or on properties, and loss of riparian function.



Zone B - Stuartburn Grasslands

This zone is comprised mainly of relatively flat lands with gradual elevation changes. The landscape is predominately grasslands with a mixture of trees or smaller blocks of forest. Smaller wetland areas are dispersed throughout this zone as compared to other zones. The western side of this zone is the escarpment region which slopes westward towards the highly fertile annual croplands of the Red River Valley.

Land use, topographic, and watershed features provide tremendous opportunity to maintain or improve riparian health in this zone. The majority of agricultural operations are forage based, thus both natural and improved riparian areas and vegetative buffers are much more prevalent in this zone than in the more intensely annually cropped Zone A. Riparian health mitigation strategies through programs and actions delivered by the Seine Rat Roseau Watershed District and its partners have generally been well received here and action continues. The Nature Conservancy of Canada is a significant landowner in the area, with a priority of natural preservation. This is often a sharp contrast to land development for agriculture and forestry.

Both artificial and natural water retention through dams, culvert gate controls, back floods and natural wetland restoration can help achieve peak flow reduction for the immediate area and downstream residents. In addition, these type of projects help mitigate drought, enhance biodiversity and recharge aquifers which most residents rely on for water.

The Stuartburn Grasslands Zone is characterized by many permanent wetlands (Classes 4 and 5) that are dispersed throughout the zone's relatively flat forage lands, and that are protected by The Water Rights Act. The Manitoba Tallgrass Prairie Preserve and other native prairie remnants provide habitat for numerous species at risk. These ecologically important features add a unique dimension to the area creating both challenges and opportunities for local land managers.

Strengthening working relationships with American counterparts like the Roseau River Watershed District will greatly strengthen surface water management strategies for this zone. The Stuartburn Grasslands zone is where headwaters originating further up in the watershed re-enter Canada after combining with flow from the American portion of the Roseau River Watershed. Large water retention sites in Minnesota called Wildlife Management Area pools provide significant control for receiving waters coming from the American side of the basin and controlled release is important to Canadian watershed residents.

Key Challenges

- Loss of wetlands and riparian areas has resulted in reduced capacity to retain water, slow runoff rates, filter nutrients and sequester carbon.
- Lack of water retention results in flooding, damage to municipal infrastructure, agricultural production losses, and property access issues.
- Improvement in cross-border management of water would help alleviate excess flow issues during high runoff events and help maintain a desirable baseflow during drier periods.
- Limited drain maintenance results in channel blockages and reduced flow capacity, thus exacerbating the extent, period and impact of excess moisture conditions for producers, property owners, and municipalities.

Crown Lands are properties under ownership and authority of the Province of Manitoba. They are managed by the province or may be under lease arrangement with private individuals, companies or groups. Crown Lands have multiple uses including grazing, hunting, recreation, timber harvest, mining, parks, ecological reserves and more.

Zone C - Sundown Plateau

This zone contains small tributaries of the Roseau River such as the Pine Creek. The elevation changes are low to moderate. This zone contains several forest and wetland complexes with some mixed agricultural operations (crops and livestock). Much of the forest, natural grassland, and wetland area is provincially-owned Crown Lands. Wetland complexes include bogs, marshes and swamps left largely intact. Together, these provide water storage, filtration, and base flow to nearby streams. They also serve as key habitat for wildlife and have many recreational benefits.

Riparian health mitigation strategies through programs and actions delivered by the Seine Rat Roseau Watershed District and its partners have been well-received in this zone and continue to be a priority.

Water retention could be optimized in this zone which would provide benefits both locally and downstream.

Key Challenges

- Loss of ecological services with Crown Land sales and corresponding land use changes. Communication and partnership in the management of provincial Crown Lands is key.
- Optimizing water retention for the benefit of local and downstream flow control.
- Accessibility of agricultural and forest Crown Lands for water retention and storage projects.

Zone D - Piney Highlands Zone

This zone includes the headwaters of the Roseau River Watershed including the Sprague Creek where topography is at its highest in the watershed. Much of this zone is covered by the Wampum and Sandilands Provincial Forests as well as privately-owned forested lands. Forest and wetlands predominate the landscape within the provincial Crown Lands, whereas privately-owned land is characterized by a combination of forest and mixed agricultural lands. Soils tend to be coarse-textured and elevation changes over short distances are generally low to moderate. Overall, there is a drop of 68m in elevation across this zone.

Key Challenges

- Continued support for sound forest management practices that preserve riparian areas, unique species and areas, and rare and representative examples of plants, animals, and geological features.
- Proper use and management of Crown Land to reduce land clearing and new drainage development.
- Accessibility of agricultural and forest Crown Lands for water retention and storage projects.
- Headwater storage has potential in the area and would especially benefit residents on both sides of the international border.

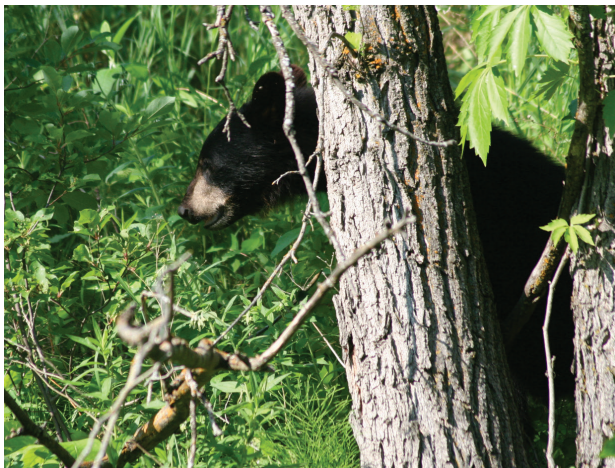


Photo credit: Benjamin Horne

Surface Water Management Plan - All Zones

Key Challenges

- Flooding of annual cropland creates farm operational, production, and financial challenges and translates into negative impacts on the local economy.
- Climate change and extreme weather events have altered surface water hydrology, including increased variability in runoff volumes.
- Limited understanding of surface water management and the need for a watershed-wide surface water management plan.
- Reduced predictability of flood events has resulted in local infrastructure damages and increased costs related to emergency relocation of residents and deployment of emergency services.
- The cross-jurisdictional nature of the watershed makes it difficult to effectively manage surface water flows and infrastructure on a seamless basis across the international and municipal borders and with many parties involved.
- Historically, there has been lack of maintenance on the existing drainage system. Excessive vegetation growth and sedimentation reduce channel flow capacities.
- Excessive, illegal, or unmanaged surface and sub-surface water drainage create negative impacts to downstream landowners, infrastructure and the environment by changing the magnitude and duration of runoff events.
- There is limited understanding of tile drainage, and its impacts to water quality and the downstream drainage systems.

- Land management practices can negatively impact surface water management by degrading riparian areas, loss of wetland habitat and water storage capacity, and lower the ability of soils to retain and use water.
- Overland flooding of agricultural lands occurs due to in-channel blockages such as ice jams, debris, and beaver activity.

Key Solutions

Water Retention

Water retention is mentioned often in the following action tables. Water retention in the simplest of terms refers to the capture of water. The duration for which water is retained depends on the end objective or use. In Manitoba, water is often retained for peak flow reduction and flood mitigation efforts, wetland enhancement or reclamation, water for agricultural crops and livestock, potable water supplies for communities, reserves for emergencies (firefighting, drought), electrical power generation, and for recreational purposes.

The primary type of water retention referred to in this plan is catch and controlled (delayed) release for reducing peak flows and runoff volumes that, if left unmanaged, can cause downstream flooding, infrastructure damage, crop and property loss, and disruption in essential services or transportation routes. Water retention is often quantified by a unit of volume called acre feet. An acre foot of retained water would cover an acre of land to a depth of one foot. The SRRWD has worked with partners to develop small- to medium-sized water retention projects (ex. 5 to 80 acre feet) for peak flow reduction purposes.

Both artificial and natural water retention through dams, culvert gate controls, back floods and natural wetland restoration can help achieve peak flow reduction for the immediate area and downstream residents. In addition, these types of projects help mitigate drought, enhance biodiversity and recharge aquifers which most residents rely on for water.

Surface Water Management Planning Using LiDAR

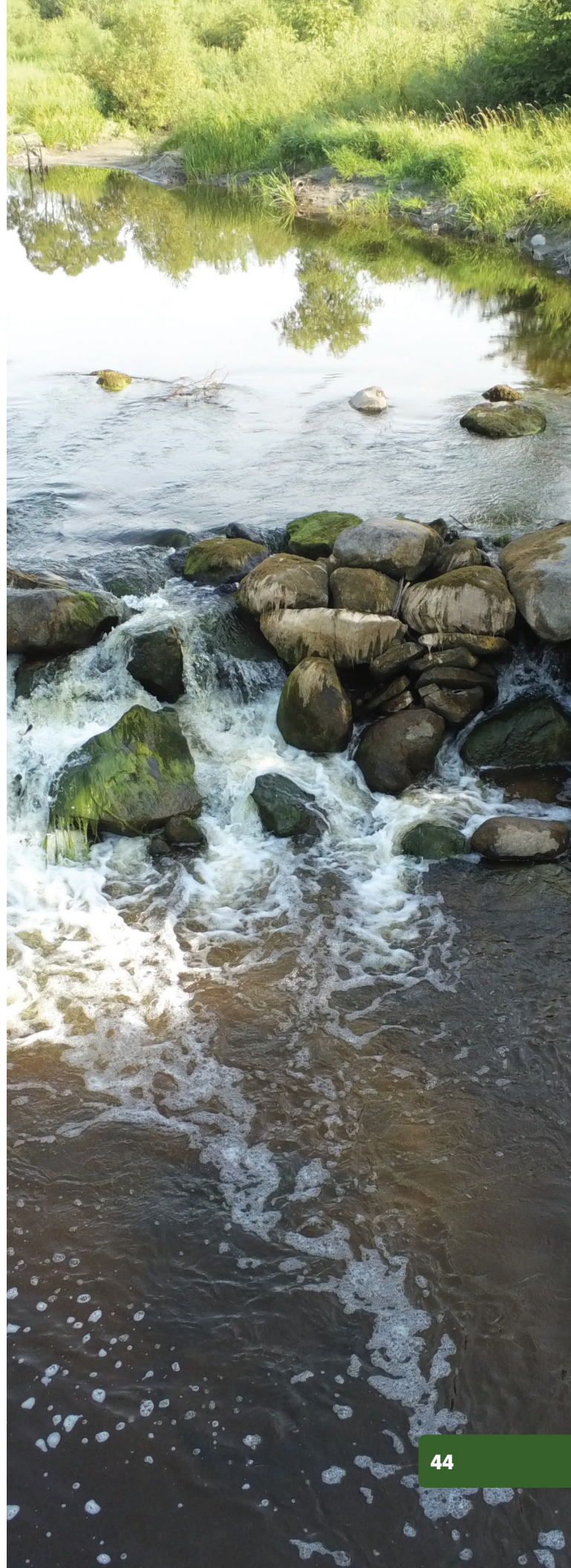
Flood mapping and other surface water management planning efforts are additional key solutions to the challenges listed on the previous page. LiDAR data are integral to these planning efforts.

LiDAR (Light Detection and Ranging) provides very detailed digital data on the elevations of the landscape. It is typically acquired by aircraft or drones that are equipped with special sensors. LiDAR coverage has been acquired for the entire Roseau River Watershed. These data were collected by the Province of Manitoba in an ongoing effort to create a seamless dataset for municipal Manitoba and continuously update data throughout the province.

Staff at the SRRWD access these data on a daily basis as it is an integral part of the project design and decision making process in the District. The in-house use of LiDAR data is a major asset to the operation of the SRRWD as it increases efficiency, reduces the need for on the ground surveys and plays a huge role in making informed decisions. Digital elevation projects such as contour lines, flow paths, retention capacities and watershed delineations are created by SRRWD staff and disseminated to sub-districts, the Board, municipalities and potential partners to assist in the decision making processes surrounding surface water management, drainage, water retention, wildlife habitat and land management.

Key Solutions

Sustainable surface water management includes natural infrastructure for flood and drought protection and sustainable drainage and is the key to addressing a multitude of surface water management challenges. Sustainable drainage is the integration of the modern drainage system with long-term environmental and societal objectives. Using a watershed-based approach will ensure that problems can be addressed without creating new challenges up or downstream.



Watershed-Wide Surface Water Management Actions

#	ACTION	PARTNER ORGANIZATIONS	MEASURE OF SUCCESS
OBJECTIVE: Build climate resiliency throughout the watershed, strategically implementing natural infrastructure and innovative surface water management strategies.			
1.01	Promote and implement flood and drought adaptation throughout the watershed with strategic partners; in particular, water retention.  Target Area: All zones	SRRWD, Manitoba Agriculture and Resource Development (Lands Branch, Water Branch), Manitoba Infrastructure, municipalities, Association of Manitoba Community Pastures, Ducks Unlimited Canada, landowners	Complete 10-15 high priority water retention projects (350-400 acre-feet of storage) over the life of the plan, contributing to RRBC's peak-flow reduction goals.
1.02	Use LiDAR and other data to develop spatial targets, flood risk maps, and hydrological models to support sustainable surface water management.  Target Area: All zones	SRRWD, Manitoba Agriculture and Resource Development, Manitoba Infrastructure, municipalities, Agriculture and Agri-Food Canada, USA partners, landowners	Develop and use LiDAR-based and other technical planning tools for project targeting (i.e., Prioritize, Target, Measure Application – PTM App; Wetland Digital Elevation Pond Modeler – WDPM).
1.03	Promote and implement best management practices for sustainable surface water management, riparian areas, soil health, and erosion control.  Target Area: All zones	SRRWD, Manitoba Agriculture and Resource Development, municipalities, Agriculture and Agri-Food Canada, landowners	Provide ecological goods and services programs, tax incentives, or other programs to support innovative surface water management. Enroll 30 acres of privately-owned land in SRRWD's ecological goods and services programs annually. Work with stakeholders to implement tax incentives and other program options for private and public lands.

#	ACTION	PARTNER ORGANIZATIONS	MEASURE OF SUCCESS
1.04	Promote and implement riparian management practices and buffer strips along key waterways and drainage systems.  Target Area: Erosion-prone, flood-prone and sensitive areas in all zones.	SRRWD, Manitoba Agriculture and Resource Development, municipalities, Agriculture and Agri-Food Canada, landowners	Establish six riparian enhancement or buffer strip projects annually. Prioritize these projects in conjunction with LiDAR-based mapping tools. Enroll 10 acres of privately-owned land in SRRWD's ecological goods and services programs annually.
1.05	Improve soil health management practices to help retain moisture and improve infiltration as part of sustainable surface water management, and provide additional benefits such as carbon sequestration.  Target Area: Sensitive, degraded and erosion-prone soils in all zones.	SRRWD, Manitoba Agriculture and Resource Development, Agriculture and Agri-Food Canada, Industry partners, Vita Beef Day, St. Jean Ag Days, Steinbach Crop Day, landowners	Establish soil health and erosion control programming. Promote soil health management practices (e.g., at local agriculture days and during surface water management meetings/workshops).
1.06	Establish shelterbelts and other plantings to strategically manage moisture, reduce erosion, and provide additional benefits (habitat, carbon sequestration, etc.).  Target Area: Erosion-prone areas in all zones.	SRRWD, Manitoba Agriculture and Resource Development, municipalities, landowners	Establish shelter belt programming. Supply 1,000 trees annually to landowners for shelter belt and tree planting.

#	ACTION	PARTNER ORGANIZATIONS	MEASURE OF SUCCESS
 OBJECTIVE: Ensure waterways maintenance proceeds in an effective and environmentally responsible manner.			
1.07	Improve the implementation, communication and coordination surrounding the development, maintenance and management of new and existing private, municipal, and provincial drains. Implement a more coordinated and effective drainage system.  Target Area: All zones	Manitoba Infrastructure, Manitoba Conservation and Climate (Manitoba Drainage and Water Control Licensing), SRRWD, Roseau River International Watershed, municipalities, landowners	Improved dialogue and cooperation between partners. Host at least one public meeting each year (to rotate through the four zones for the duration of the plan) to address surface water management.
1.08	Provincial drain infrastructure maintenance considers downstream to upstream effects and considers surface water management options such as water retention, drop structures and sediment traps.  Target Area: Zones A, B, and C	Manitoba Infrastructure, SRRWD, municipalities	In-channel drainage improvements and maintenance within and upstream of provincial drains are prioritized using LiDAR-based tools and with the input of all partners (per 1.07).
1.09	Implement a sustainable beaver management program to improve surface water flows.  Target Area: All zones	Municipalities, SRRWD, Industry partners	Implement strategic beaver management projects, such as pond levelers, beaver cones, beaver stops, and stream masters.
1.10	Work with partners to develop new (or refine existing) guidelines, by-laws and beneficial management practices (BMPs) for tile drainage.  Target Area: All zones	Manitoba Conservation and Climate, Manitoba Agriculture and Resource Development, SRRWD, municipalities, Industry partners, Red River Basin Commission	Establish guidelines, policies and BMPs for tile drainage which are technically consistent but regionally customized across the watershed.

#	ACTION	PARTNER ORGANIZATIONS	MEASURE OF SUCCESS
 OBJECTIVE: Improve communication and education around surface water management locally, inter-municipally and internationally			
1.11	Work with American partners to store, control and manage surface water that flows across the border and coordinate its release.  Target Area: All zones (where subwatersheds flow over the international border)	Red River Basin Commission, Manitoba Agriculture and Resource Development, Manitoba Infrastructure, Minnesota Department of Natural Resources, Roseau River Watershed District, Roseau River International Watershed, SRRWD, municipalities	Strive for a consistent and coordinated notification system between upstream and downstream partners across the International border of Canada and the USA in regards to any upstream operational changes (e.g., Roseau River Wildlife Management Area pool dams). Continue to foster an effective trans-boundary partnership to manage water.
1.12	Promote educational outreach with American partners with the intention of cultivating a cultural and philosophical change of how we perceive and manage water.  Target Area: All zones	Roseau River International Watershed, Roseau River Watershed District, SRRWD, municipalities	Host outreach events, tours and demonstrations, and circulate promotional materials amongst the public. Record the number of partnerships gained with landowners, corporations and municipalities. Encourage continued participation in the Roseau River International Watershed.
1.13	Conduct education and training opportunities that promote sustainable drainage, water retention and other sustainable surface water management practices.  Target Area: All zones	Municipalities, Manitoba Agriculture and Resource Development, SRRWD, Agriculture and Agri-Food Canada	Host at least one surface water management education and training event each year (to rotate through the four zones) for the duration of the plan. Events should include education on LiDAR- based tools and other technical innovations available for surface water management practices.

Zone-Specific Actions

Zone A - Emerson - Dominion City Flats

Zone B - Stuartburn Grasslands

Zone C - Sundown Plateau

Zone D - Piney Highlands

#	ACTION	PARTNER ORGANIZATIONS	MEASURE OF SUCCESS
1.14	Re-establish, maintain and enhance riparian zones in chronic flood-prone areas that are currently in cultivation.  Target Area: Chronic flood-prone areas in Zones A and B	SRRWD, Manitoba Agriculture and Resource Development, conservation-based agencies, landowners	Enroll 10 acres of privately-owned, flood-prone riparian zones in SRRWD's ecological goods and services programs annually. Provide landowners with information about conservation easements and other programming.
1.15	Targeted water retention to reduce downstream flooding, reduce nutrient export and improve water management.  Target Area: Chronically flood-prone and nutrient-exporting areas in Zones B and C	SRRWD, Manitoba Agriculture and Resource Development, landowners	Establish one water retention project in the Stuartburn Grasslands and Sundown Plateau annually. Enroll 10 acres of privately-owned land in SRRWD's ecological goods and services programs for water retention annually.
1.16	Conduct drain restoration and maintenance along provincial drains.  Target Area: Provincial drains in Zones A and B	Manitoba Infrastructure, municipalities	Address at least one drain restoration/maintenance project every year for the duration of the plan.
1.17	Implement innovative erosion control measures along provincial and municipal drains that enter the Roseau River.  Target Area: Provincial and municipal drains in Zones A, B, and C	Manitoba Infrastructure, SRRWD, municipalities, landowners	Complete erosion control measures on priority drains annually.
1.18	Maintain the Gardenton Floodway for flow control into the Roseau River.  Target Area: Zone B	Manitoba Infrastructure	Prioritize annual maintenance of Gardenton Floodway.

#	ACTION	PARTNER ORGANIZATIONS	MEASURE OF SUCCESS
1.19	Maintain the Z-dike for flood control and water retention purposes.  Target Area: Zone B	RM of Stuartburn	Continual maintenance of the Z-dike for flood protection.
1.20	Maintain and enhance existing Ducks Unlimited Canada infrastructure (at Horseshoe Lake) for sustainable water storage.  Target Area: Zone C	Ducks Unlimited Canada, Manitoba Agriculture and Resource Development, SRRWD, municipalities	Work towards completion of water retention project at Horseshoe Lake. Project to begin by 2023. Work towards implementing successful surface water management at Horseshoe Lake using LiDAR-based tools. Work with key partners to discuss additional innovative surface water management solutions in the Horseshoe Lake area.
1.21	Restrict the sale or lease of marginal Crown Lands that contain permanent and semi-permanent wetlands, or that are prone to flooding.  Target Area: Zone C	Manitoba Agriculture and Resource Development (Manitoba Lands Branch), Manitoba Municipal Relations (Community Planning), municipalities	If provincial Crown Lands are to be leased or sold, SRRWD should provide comments regarding water management opportunities. If provincial Crown Lands are sold, the purchaser should be made aware that there are no guarantees that drainage improvements will be approved or that access will be provided. New municipal development plans reduce the potential negative impact of municipally-owned land sales.
1.22	Implement water retention projects on Crown Lands that improve surface water management for the watershed while achieving the objectives of the Crown Land use designation.  Target Area: Zones C and D	SRRWD, Manitoba Agriculture and Resource Development (Manitoba Lands Branch)	Develop partnerships and improve communication with Manitoba Lands Branch to identify and prioritize potential projects. 2-3 water retention projects implemented on Crown Lands throughout the life of this plan.

#	ACTION	PARTNER ORGANIZATIONS	MEASURE OF SUCCESS
1.23	Redesign and reconstruct the inter-municipal ditch between the RMs of Piney and Stuartburn with input from all impacted partners.  Target Area: Zone C (Road 54E, starting at Sprague/ Morden road, heading three miles south)	Municipalities, Manitoba Agriculture and Resource Development, Manitoba Infrastructure	Inter-municipal ditch upgrades completed by 2022.
1.24	Ensure harvesting activities on forested lands are conducted using sustainable forestry management practices, including reforestation.  Target Area: Zone D	Manitoba Agriculture and Resource Development	Educational workshops are held upon request. Municipalities, SRRWD, Indigenous communities, and other industry partners to ensure sustainable forest harvesting and reforestation practices are being implemented (e.g., after fire, insect outbreak or extreme wind events).
1.25	Promote new surface water management and water retention projects, including those that could serve multiple benefits for forest/wild fire fighting.  Target Area: Zone D	SRRWD, Manitoba Agriculture and Resource Development (Manitoba Lands Branch), municipalities, landowners	Work with partners to identify and implement retention projects using LiDAR-based tools, GIS mapping of fire-prone areas, and knowledge of water needs for fire-fighting.
1.26	Where Crown Lands and municipal lands are sold or leased, the purchaser should be made aware there are no guarantees drainage improvements will be approved or property access will be provided.  Target Area: Zone D (and some locations in Zones B and C)	Manitoba Agriculture and Resource Development (Manitoba Lands Branch), Manitoba Municipal Relations (Community Planning), municipalities	New provincial policy and municipal development plans that identify development restrictions (drainage, access, bush clearing) on Crown Lands sales. Improve communication between planning districts and provincial departments and explore opportunities to restrict clearing and drainage of both Crown Lands and privately-owned lands.

#	ACTION	PARTNER ORGANIZATIONS	MEASURE OF SUCCESS
1.27	Promote forest management practices that positively impact surface water (e.g., water quality, erosion, peak flow reduction) and fire management.  Target Area: Zones C and D	Manitoba Agriculture and Resource Development, SRRWD, municipalities	Compliance with current legislation and best management practices on all logging quotas issued on provincial land.
1.28	Maintain and protect permanent forest cover for surface water management benefits and erosion control.  Target Area: Forested areas in Zone D susceptible to land use conversion (and all zones where applicable).	SRRWD, Manitoba Agriculture and Resource Development, municipalities	Establish programming to protect forest cover (ecological goods and services programs, conservation easements).
1.29	Limit the deforestation/clearing of private land in predominantly wooded and wetland areas (e.g., 20% of forested area must be maintained upon sale of any private parcel).  Target Area: Zones C and D	Manitoba Conservation and Climate, planning districts, municipalities	Enforce existing legislation protecting wetlands and establish restrictions on the clearing of sensitive forested and wetland areas. Incorporate these restrictions in development plans for adoption by municipalities.
1.30	Ensure development of lands for peat harvesting is done in a sustainable manner.  Target Area: Zones C and D	Manitoba Agriculture and Resource Development, SRRWD, Rural Municipality of Piney, Buffalo Point First Nation, Peat Industry	Ensure all peat development follows provincial license and permit conditions for peat harvesting. Foster discussions between stakeholders.





Implementation Plan

Priority 2: Groundwater Quality and Quantity

GOAL: Protecting the Quality and Quantity of Groundwater

Most residents of the Roseau River Watershed rely on groundwater for domestic water supply. This includes water for household use, community and public facilities, livestock watering, crop irrigation, commercial business use and more. The importance of maintaining the integrity and quality of the groundwater supply was noted by many residents. This may be achieved by improving local knowledge on the location and extent of local aquifers, undertaking well health assessments and water testing, performing routine well maintenance, sealing abandoned wells, and implementing beneficial management practices to protect wellheads and groundwater recharge areas. Preservation and enhancement of aquifer yields is dependent upon many natural and societal factors, including the nature, depth and size of geological deposits, drought and wet cycles, groundwater recharge, land use practices, and water use allocations.

Key Challenges

- Overland flooding or surface water pooling near poorly constructed or abandoned wells.
- Source water protection for public drinking water systems to protect water quality and health of residents.
- Aquifer contamination through abandoned wells. Many wells have historically been developed for agricultural operations and farmsteads.
- Proper well sealing helps provide one line of defense against local contaminants reaching groundwater.
- Nutrient loss from fields and livestock confinement facilities can deteriorate surface and groundwater quality if not managed properly.
- Shallow wells are at risk of becoming dry during drought conditions (in Zones B and C primarily).

Groundwater Quality and Quantity Actions

#	ACTION	PARTNER ORGANIZATIONS	MEASURE OF SUCCESS
 OBJECTIVE: Protect drinking water sources from contamination.			
2.01	Seal abandoned wells and conduct dormant well protection and well head remediation on private and public lands.  Target Area: Watershed-wide	SRRWD, Manitoba Agriculture and Resource Development (Groundwater Management Section, Lands Branch), municipalities, landowners	Continue to implement a comprehensive groundwater protection program. Target of 2-3 dormant wells protected, well heads remediated and/or abandoned wells sealed per year to protect groundwater resources.
2.02	Promote well management practices with landowners for groundwater protection (e.g., proper well site selection, proper well head area management, well pit decommissioning).  Target Area: Watershed-wide	SRRWD, Manitoba Agriculture and Resource Development, Manitoba Conservation and Climate (Office of Drinking Water), municipalities, well drillers	Provide educational outreach materials to all municipal partners, SRRWD offices, and well drillers for public distribution.
2.03	Promote and offer well-shock chlorination services.  Target Area: Watershed-wide	SRRWD, local organizations or businesses	Provide well-shocking services to residents and provide educational outreach materials on the benefits of well-shock chlorination as part of proper well maintenance.

#	ACTION	PARTNER ORGANIZATIONS	MEASURE OF SUCCESS
2.04	Promote well assessments and water quality testing for groundwater wells. Use results to promote sustainable well practices.  Target Area: Watershed-wide	SRRWD, Manitoba Agriculture and Resource Development, Manitoba Conservation and Climate (Office of Drinking Water), municipalities, landowners	Number of wells tested by well inventory program and well testing days. Number of wellhead assessments provided to watershed residents.
2.05	Promote responsible nutrient management practices and provide information on regulatory requirements to reduce risks of groundwater contamination.  Target Area: Watershed-wide	SRRWD, Manitoba Agriculture and Resource Development, landowners	Implement 2 projects annually with beneficial management practices such as exclusion fencing, alternative watering systems, and livestock runoff control systems.
 OBJECTIVE: Improve education and awareness of groundwater management.			
2.06	Update aquifer mapping using available information as resources permit.  Target Area: Watershed-wide	Manitoba Agriculture and Resource Development (Groundwater Management Section), SRRWD	Aquifer delineation maps made available to the public at the SRRWD office and provincial website.
2.07	Ensure flowing artesian wells are properly constructed and managed to limit damages to downstream landowners and infrastructure and to promote sustainable use of groundwater resources.  Target Area: Watershed-wide - areas with flowing wells	Well drillers, Manitoba Agriculture and Resource Development (Groundwater Management Section), RMs, landowners	Educational outreach materials to be provided to all municipal partners and SRRWD offices for public distribution. Groundwater from flowing artesian wells is under control as required by regulation.
2.08	Ensure any location with 15 or more service connections (e.g., campgrounds, trailer parks, etc) are operating as a public drinking water system. Promote community/shared water where it makes sense.  Target Area: Watershed-wide	Manitoba Conservation and Climate (Office of Drinking Water), municipalities	All public drinking water systems operate under licence.
2.09	Promote ongoing education on Community Wells for non-potable water use.  Target Area: Watershed-wide	Municipalities, Manitoba Conservation and Climate (Office of Drinking Water)	Establishment of permanent signage and ongoing availability of educational material at Community Wells sites.

Source Water Protection Assessments

Clean, potable drinking water is critical for human life and prosperous, sustainable communities. Protecting water at its source, before it arrives at treatment facilities, is a preventative approach to water management. This approach is less expensive and more ecologically considerate than the time, effort and expense to treat large volumes of water for domestic use in treatment facilities to meet water quality standards.

The approach to source water protection planning varies widely across Canada. In Manitoba, source water assessments are conducted by a group of technical experts and local representatives.

Public Drinking Water Systems in the Roseau River Watershed

Source water assessments were completed for two public drinking water systems in the watershed. The Office of Drinking Water (ODW) defines a public water system as a potable supply of drinking water with 15 or more connections. It is also important to note that there are a number of semi-public systems, which consist of more than one but less than 15 connections, and private wells located within the watershed. The assessment teams relied on the ODW to provide technical advice for these public systems, and were comprised of a regional drinking water officer, a watershed planner, the operator of the system and sometimes watershed district staff and board members, planning team members, and municipal representatives.

SITE SPECIFIC ACTIONS (Recommended By Assessment Team)

PUBLIC SYSTEM	ACTIONS
Vita Trailer Park	Ensure well cribbing lid is in place, secured and properly fitted over the well casing to eliminate direct entry to the well. (Completed) Provide septic tank maintenance information to the system owner. Septic tank for house trailer adjacent to well house (within 20 metres) should have regular pump-outs and inspections of the septic tank to ensure there are no leaks. When replaced, septic tank should be moved to a new location to allow adequate buffer.
Pineland Hutterite Colony	The wellhead runs a risk of being struck by equipment or vehicles given its proximity to buildings and traffic movement. It may also get concealed under snow during heavy snowfall years and thus could be struck by snow clearing activities. Some raised pole stops or guards placed around the perimeter of the well is recommended. A small cement pad should be poured around well casing at ground surface to ensure a tight seal of any secondary covers/lids.



Implementation Plan

Priority 3: Surface Water Quality

GOAL: Protecting and Improving Surface Water Quality

Residents value and depend on the water quality of the Roseau River, its tributaries, and wetlands throughout the watershed for wildlife, recreational, and agricultural purposes. Surface water within the watershed is linked to groundwater recharge and can influence the quality of groundwater in many places. In addition, high nutrient concentrations in the Roseau River can negatively impact local water quality and downstream receiving bodies such as the Red River and Lake Winnipeg.

Key Challenges

- Surface water management practices such as drainage can degrade water quality by releasing nutrients and sediments into waterways.
- Nutrients applied to agricultural lands in excess of crop requirements can lead to a build up of nutrients in the soil, nutrients that can then run off into waterways.
- Forest timber harvest and peat mining activities can release nutrients and sediments into waterways.
- Improper management of public and private septic systems can result in nutrient and bacteria entering surface waterways.
- Loss and degradation of riparian zones, stream banks and waterway buffers may result in reduced filtration of runoff water, release of nutrients from fields and other areas, and increase sediment loads in water.
- Loss of wetlands results in less natural filtration and water storage which can deteriorate downstream water quality.

Surface Water Quality Actions

#	ACTION	PARTNER ORGANIZATIONS	MEASURE OF SUCCESS
 OBJECTIVE: Reduce phosphorus and nitrogen loading to waterways by 20%.			
3.01	Reduce erosion and nutrient transport within waterways through riparian area management, BMP adoption by producers, and re-establishment of riparian buffer zones to limit disturbance of sensitive riparian soils.  Target Area: Riparian areas throughout watershed	SRRWD, Manitoba Agriculture and Resource Development, Manitoba Conservation and Climate, municipalities, landowners	50% of riparian areas along waterways have riparian management practices in place (e.g., grassed waterways, buffer strips, livestock exclusion fencing, offsite watering systems, etc).
3.02	Reduce nutrient loading to local waterways through annual harvesting of vegetation from riparian buffer zones (see action 1.04).  Target Area: All zones (water retention areas, riparian areas, provincial and municipal rights-of-way, Crown Lands, private land)	SRRWD, Manitoba Agriculture and Resource Development, municipalities, landowners	25% of riparian buffer zones adjacent to cultivated agricultural lands are under a harvesting management plan (e.g., harvesting and baling riparian vegetation or cattails; “flash” grazing by livestock to remove biomass).

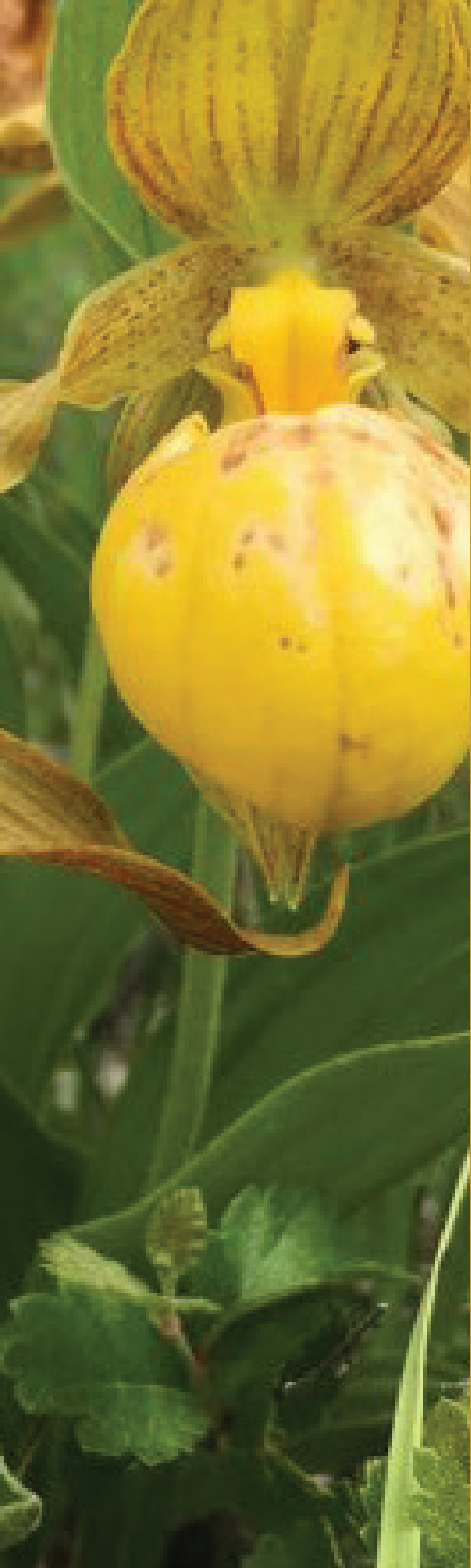
#	ACTION	PARTNER ORGANIZATIONS	MEASURE OF SUCCESS
3.03	Reduce annual cropping within riparian setbacks and Crown Lands through perennial cover re-establishment (see action 1.04), annual harvesting of biomass (see action 3.02), and adoption of new policies and bylaws.  Target Area: Provincial and municipal rights-of-way, provincial drains, Crown Lands, private land	Municipalities, Manitoba Agriculture and Resource Development (Lands Branch), SRRWD	Enroll 10 acres of privately-owned land in SRRWD's ecological goods and services programs for perennial cover annually. Adoption of new municipal bylaws restricting annual cropping in these areas. Adoption of new agricultural crown lease policies restricting annual cropping near waterways.
3.04	Reduce through enforcement incidences of non-compliance with the Livestock Manure and Mortalities Regulation with respect to manure application encroachment to waterways and ditches.  Target Area: Zone A; other zones where cultivated lands are adjacent to riparian zones, waterways and ditches	Manitoba Conservation and Climate, municipalities, industry, landowners	Reduction in noticeable and reported infractions to the Regulation.
3.05	Conserve, enhance and restore existing and vulnerable natural wetlands.  Target Area: Watershed-wide	Conservation-based agencies, Manitoba Agriculture and Resource Development, SRRWD, municipalities, landowners	Establish a complete wetland inventory for the entire watershed. Enroll 10 acres of wetlands on privately-owned land in SRRWD's ecological goods and services programs annually.
3.06	Improve erosion control practices on annual cropped land on fields.  Target Area: Erosion-prone soils, annual cropland, and other sensitive areas	SRRWD, municipalities, landowners	Implement runoff control programs (i.e., grassed buffer strips along field edges, outlet controls for field runoff, other innovative practices). Development and promotion of a shelterbelt program (including boundary shelterbelts).

#	ACTION	PARTNER ORGANIZATIONS	MEASURE OF SUCCESS
3.07	Improve erosion control practices in urban and rural residential environments to enhance nutrient and sediment capture and filtration.  Target Area: Urban areas, rural residential developments	SRRWD, municipalities, LUDs, landowners	Implement 1 project annually (storm water runoff control such as rain gardens, sediment basins, swales, and constructed wetlands)
3.08	Encourage the adoption of soil health management practices to maximize nutrient uptake, water holding capacity of the soil and improve water quality (see action 1.05).  Target Area: Agricultural lands watershed-wide	Manitoba Agriculture and Resource Development, SRRWD, municipalities, agricultural suppliers, retailers and manufacturers, landowners	Establish soil health and erosion control programming. Promote soil health management practices and provide information transfer opportunities (e.g., at local agriculture days and during surface water management meetings/ workshops).
3.09	Stabilize stream banks along provincial waterways.  Target Area: Provincial waterways, including Vita Drain and Pine Creek Diversion	Manitoba Infrastructure	Begin reconstruction of degraded portions of Vita Drain and Pine Creek Diversion within two to five years of plan implementation. Native riparian seed mix is used in all provincial infrastructure reconstruction projects.
3.10	Monitor and enforce relevant environmental wastewater management legislation and regulations.  Target Area: Watershed-wide	Manitoba Conservation and Climate (Environmental Compliance and Enforcement Branch)	Increased communication on monitoring and enforcement activities between Environmental Compliance and Enforcement Branch and respective municipalities (targeted reports on infractions and how they were addressed) to improve accountability and understanding. Increase communication between province and SRRWD about municipal lagoon discharges to improve nutrient monitoring efforts.

#	ACTION	PARTNER ORGANIZATIONS	MEASURE OF SUCCESS
▶ OBJECTIVE: Obtain a better understanding of current water quality and nutrient source inputs in the Roseau River Watershed.			
3.11	Monitor water quality in rivers and tributaries to understand trends and high nutrient export sub- watersheds. 🎯 Target Area: Watershed-wide	Manitoba Agriculture and Resource Development, SRRWD, municipalities, Lake Winnipeg Foundation, South Central Eco Institute, local schools, local volunteers	Prepare an established water sampling program and protocols for the watershed. Maintain current long-term monitoring sites within the watershed. Annual report of water quality results (published on SRRWD website) and publicized through local municipalities.
3.12	Use benthic macroinvertebrate monitoring program to gauge watershed health over time. 🎯 Target Area: Watershed-wide	SRRWD, Environment and Climate Change Canada	Complete watershed health report cards to track changes in benthic macroinvertebrate community composition. Monitor at least four sites per year across the watershed for the duration of the plan as resources allow.
▶ OBJECTIVE: Water quality innovation and education is promoted by all partners.			
3.13	Educate landowners on the importance of properly monitoring and maintaining onsite wastewater management systems. 🎯 Target Area: Watershed-wide	SRRWD, Manitoba Conservation and Climate, municipalities, Manitoba Onsite Wastewater Management Association	Increase technical/informative documents and presentations circulated locally.
3.14	Promote the use of hazardous waste collection systems or practices within the watershed at a municipal, farm, commercial business, and homeowner level. 🎯 Target Area: Watershed-wide	Municipalities, Manitoba Conservation and Climate, industry, SRRWD, local weed districts	Increased adoption of hazardous waste practices by municipalities, businesses, and homeowners.
3.15	Continue to initiate innovative technologies and methodologies/ BMPs to further water quality enhancements. 🎯 Target Area: Watershed-wide	Post-secondary institutions, SRRWD, Agriculture and Agri-Food Canada, landowners	Investigate and pilot innovative technologies and methodologies as they arrive, including biomass harvesting to remove phosphorus, etc.



Photo credit: Sara Schubert



Implementation Plan

Priority 4: Ecosystem Health and Natural Areas

GOAL: Enhancing and Protecting Ecosystem Health and Natural Areas

Natural areas are vital to enhancing biodiversity, from the smallest insects to a variety of plant species and larger wildlife. Natural areas in the Roseau River Watershed include riparian areas, streams, lakes, wetlands, forests and grasslands. Key ecological functions are performed within these natural areas to ensure plant, animal, insect and aquatic species can interact, survive and prosper. These natural areas preserve biodiversity and are important to the overall food chain on which nature and humans rely. In addition, these natural areas provide vital recreational and tourism opportunities for people within and beyond the borders of the Roseau River Watershed. Strong partnerships, education, programming, and development practices are vital to ensuring the health, availability, and functions that natural areas provide are enhanced and protected for all residents and species of the watershed.

Key Challenges

- Loss of wetlands has direct impact on biodiversity through species and habitat loss. Climate change and extreme weather events influence biodiversity in the watershed due primarily to changes in moisture and temperature regimes (warmer and drier). Such events reinforce the need to maintain and enhance existing biodiversity hot spots.
- Loss of biodiversity due to damage to habitat from more frequent, repeated and excess overland flooding during periods of high runoff.
- Impaired biodiversity due to waste disposal and treatment activities can release nutrient, chemical, and bacterial constituents into the environment.
- Increased rural, agricultural, forestry and recreational development, which places pressure on biodiversity through changes in land, shoreline and water body use, especially if not properly managed. These pressures can interfere with natural interactions and processes, release foreign compounds or nutrients and change species composition.
- Stream bank erosion can impair and destroy important habitat for both terrestrial and aquatic species, such as the endangered mapleleaf mussel, through sedimentation and changes in water quality (for example, increased turbidity).
- Changes in the long-term health of riparian areas has corresponding effect on biodiversity.

Ecosystem Health and Natural Area Actions

#	ACTION	PARTNER ORGANIZATIONS	MEASURE OF SUCCESS
 OBJECTIVE: Implement programs and projects to enhance and protect habitat throughout the watershed, including aquatic and upland habitats.			
4.01	Identify and protect locally intrinsic or sensitive areas through ecological goods and services programs, development policies, or conservation easements.  Target Area: Watershed-wide	SRRWD, municipalities, conservation-based agencies	Implement five projects annually to support protection of critical areas in the watershed.
4.02	Promote preservation and restoration initiatives for habitat, particularly for terrestrial and aquatic species-at-risk in the watershed.  Target Area: Watershed-wide	Manitoba Agriculture and Resource Development, SRRWD, Manitoba Conservation and Climate, municipalities, Indigenous communities, Conservation Data Centre, conservation-based agencies	Increased habitat for species-at-risk in the watershed.

#	ACTION	PARTNER ORGANIZATIONS	MEASURE OF SUCCESS
4.03	Educate landowners on the importance of sustainable private woodlot management practices.  Target Area: Forested areas under private ownership	Manitoba Agriculture and Resource Development, SRRWD, landowners	Increase number of private woodlots operated under management plans over duration of plan.
4.04	Undertake riparian area health assessments along the Roseau River and tributaries.  Target Area: Watershed-wide	SRRWD, Manitoba Agriculture and Resource Development, conservation-based agencies	Number of assessments completed and area covered. Target goal of 1 to 2 assessments per year.
4.05	Undertake a Roseau River fish inventory and assessment.  Target Area: Watershed-wide	Manitoba Agriculture and Resource Development (Wildlife, Fisheries and Resource Enforcement Branch), SRRWD, municipalities, recreational and wildlife groups	Completion of an updated fish inventory to establish a baseline on species composition and numbers to facilitate restoration initiatives for Roseau River.
 OBJECTIVE: Enhance partnerships that increase environmental awareness and provide economic development opportunities.			
4.06	Establish and promote existing school education and youth activities focused on ecosystem health.  Target Area: Watershed-wide	SRRWD, Province of Manitoba, municipalities, Indigenous Communities, South Central Eco Institute, Tall Grass Prairie Preserve, conservation-based agencies, schools	Number of ecosystem health workshops and events targeting youth.
4.07	Promote sustainable tourism opportunities such as hunting, fishing, camping and water-based recreational activities to foster a conservation ethic.  Target Area: Watershed-wide	Municipalities, Industry partners, local tourism groups, recreational groups, local outfitters and campgrounds, local wildlife groups, Tall Grass Prairie Preserve	Increase in use of recreational areas in watershed over the duration of the plan.

#	ACTION	PARTNER ORGANIZATIONS	MEASURE OF SUCCESS
4.08	Improve public access along the Roseau and tributaries for recreational activities, including installation of new boat launches, campgrounds, canoe paths, nature trails, etc. to foster a conservation ethic.  Target Area: Watershed-wide	Manitoba Conservation and Climate, Manitoba Agriculture and Resource Development (Lands Branch), SRRWD, Roseau River International Watershed, municipalities, recreational groups, Sunrise Corner, local tourism groups, Eastman Tourism	Greater access for the public to enjoy the Roseau River and tributaries for recreation. Improve staging areas/recreational spots for canoeists, hikers, snowmobilers, ATV riders. Publication of informative brochures, identifiable location maps and on site signage along navigable portions of the waterway.
4.09	Limit ATV and snowmobile use to a designated trail system for the protection of watershed health and develop educational material on the impact of ATV and snowmobile use on the natural environment.  Target Area: Watershed-wide	Snoman, Manitoba Conservation and Climate, Manitoba Agriculture and Resource Development, municipalities, ATV Manitoba, local economic development groups (Sunrise Corner, Eastman Tourism), local fundraising (derby) groups	Less destruction of sensitive watershed resources caused by ATV and snowmobile use. Creation of educational material on the impact of ATV and snowmobiles on the natural environment.

Linking to Development Planning

Throughout Manitoba, including the Roseau River Watershed, there is interest in developing our natural resources and landscapes for a diversity of uses like forestry, mining, tourism, agriculture, recreation, settlement and other land uses. To sustain a healthy watershed, it is important that the demand for development is balanced with the need to protect and preserve valuable resources and the environment.

Through the Provincial Planning Regulation, local land use planning carried out by municipalities and planning districts helps communities establish their vision for the future use of land, resources and natural features, and outlines the steps required to achieve that vision. It involves managing land uses and deciding where best to develop homes, parks, agriculture and industry, and where things should be left in their natural state. Land use planning is an essential part of building healthy, prosperous and sustainable communities, and is therefore closely linked with the integrated watershed management planning process.

Development Planning Authorities

The following groups are responsible for development planning within the Roseau River Watershed:

Municipal Planning

- Rural Municipality of Piney
- Municipality of Emerson-Franklin
- Rural Municipality of Stuartburn
- Rural Municipality of Montcalm

Indigenous

- Roseau River First Nation
- Buffalo Point First Nation

Provincial

- Manitoba Agriculture and Resource Development – Lands Branch
- Manitoba Municipal Relation – Community Planning

Watershed Wide Considerations for Development

The following recommendations should be considered by development planning authorities when creating or amending their development plans within the Roseau River Watershed:

Recommendations for new and existing development

- Establish restrictions or offsets to prevent annual cropping in municipal ditches to maintain longevity and performance of the overall drainage network in terms of flow control, excess sedimentation, erosion prevention, and filtration benefits.
- Work with SRRWD when developing areas prone to overland flooding. The SRRWD will provide flood risk mapping.
- Adopt policies to limit development below 200 year flood event or high water mark levels where appropriate along natural waterways, as well as in areas prone to overland flooding
 - a. to reduce the risk of erosion,
 - b. to limit and mitigate impacts of flooding,
 - c. to preserve the ecological function and aesthetics of riparian areas.
- Develop policies that establish restrictions on the clearing of sensitive forested and wetland areas from private land.
- Develop policies that will restrict land clearing at a percentage determined on an individual land parcel basis when Crown Lands are sold to private individuals.
- Develop or amend local policies for tile drainage that align with Provincial requirements. Strengthen local policies above minimum Provincial requirements where necessary.

- Adopt policies that encourage innovation and practices that help reduce, capture and utilize surface runoff including naturalized storm water runoff systems, retention basins, re-vegetation strategies and (urban) rain gardens where appropriate.

Recreational development considerations

- Adopt policies that support future recreational development like river access points, interpretive trails, and corridors along the Roseau River and other key tributaries while still maintaining ecosystem health.
- Allow for the creation of recreational ATV and snowmobile trails, boat launches and camp sites that support tourism yet help maintain and protect natural areas.

Ecological considerations

- Adopt policies to protect locally intrinsic or sensitive areas. This can include, but is not limited to, river and stream corridors, bogs, marshes, swamps, forests and grasslands.
- Restrict the sale of Crown Lands that contain permanent and semi-permanent wetlands or that are prone to flooding. If Crown Lands are sold, the purchaser should be made aware that there are no guarantees that drainage improvements will be approved or that road access will be provided.
- Develop policies for drought preparedness.

To address development concerns, the Seine Rat Roseau Watershed District would like to work with municipalities and comment on development activities that may impact watershed resilience. The table below provide general comments for development in the watershed.

GENERAL COMMENTS FOR DEVELOPMENT IN THE WATERSHED

DEVELOPMENT TYPE	COMMENTS
Planning	Development in low lying areas prone to flooding should be avoided. Flood risk mapping created by SRRWD should be used in assessing development risks.
Drainage	Significant changes in local or sub-watershed wide drainage will impact runoff peaks and volumes and put pressure on downstream residents, municipal infrastructure, and man-made or natural drains and waterways. Recommend retention opportunities to offset drainage improvements.
Industry	May result in risks for groundwater contamination. SRRWD may recommend development restrictions within groundwater recharge areas.
Residential Development	May result in negative impacts to natural areas and wetlands. SRRWD will recommend natural habitat offset opportunities, including no-net loss of wetlands.

Moving Forward – Steps for a Healthy Roseau River Watershed

The most important aspect of the Roseau River Integrated Watershed Management Plan is implementation. Without a concerted effort to implement recommended actions, this plan would be no more than a list of good intentions. The Seine Rat Roseau Watershed District, municipalities, government, Indigenous communities and local residents must strive to work together to ensure the recommendations outlined in this plan are implemented successfully.

Implementation progress and plan success will be assessed regularly over the next ten years. After five years of implementation the priorities of this plan will be revisited. An interim assessment of plan implementation progress will be conducted and shared with the stakeholders, all levels of government and watershed residents. A new plan will be developed in ten years.



References and Plan Linkages

Agriculture and Agri-Food Canada - 2015 AAFC Crop Inventory.

Manitoba Agriculture and Resource Development. 2016. Roseau River Watershed Distributed Retention Study.

Manitoba Agriculture and Resource Development. 2017. Roseau River Watershed Drought Preparedness Study.

Manitoba Southern Peatland Inventory

Ralley, W.E. (1998). Water Quality of the Roseau River 1996 to 1997 Status Report. Water Quality Management Section Manitoba Environment Report No. 98-02.

Red River Basin Commission
redriverbasincommission.org

Red River Watershed Management Board
rrwmb.org

Roseau River International Watershed. 2007. Roseau River Watershed Plan

Roseau River Watershed District
roseauriverwd.com

Seine Rat Roseau Watershed District
SRRWD.ca

SPADA (2005). Project Results of Assessment of Water Quality in Roseau River Watershed 2004-2005.

Stuartburn Piney Agricultural Diversification Association. Water Sampling Reports.

Watershed Management Planning in Manitoba
manitobawatersheds.ca



SEINE RAT ROSEAU
WATERSHED DISTRICT